THE CATHEDRAL OF CHARTRES.

It appears probable from some ancient manuscripts, that the Cathedral of Chartres was originally built on the site of an ancient Druidical temple.

St. Savinien and St. Potentien, founders of the Metropolitan church of Sens, coming to Chartres, St. Aventin, their disciple, built the first Christian church in that city, about the end of the 3rd century. The faithful suffered great persecution under the Roman dominion; but, in 313, under the emperor Constantine, the inhabitants of Chartres founded, in conjunction with their bishop, a temple to God upon the very spot where the church now stands.

This church was burnt about the year 858 by the Normans, who entered the town under the pretext of receiving baptism there. Rebuilt by Bishop Gislebert, the church again suffered in the war between Thibaud and Richard, duke of Normandy. In 1040, it was again reduced to ashes by lightning, being probably built of wood, as were many churches of the 6th and 7th centuries. The pious Fulbert, who was bishop at this time, sought the assistance of the different sovereigns of Europe for the re-construction of the building, devoting for three years his own income to the same object. A large sum was consequently raised.

We have little idea, at the present time, with what zeal and perseverance christians then devoted themselves to such enterprises: they frequently undertook severe manual labour in the erection of new churches; and pilgrims even came from Rouen and other places to assist in its execution.

These pilgrimages and labours were performed with the best intentions. The persons who undertook them generally made up their past quarrels, and many a process of law was thus determined. They nominated a chief, who allotted to each his employment; the works were executed in the fine season of the year; wax tapers were placed in the waggons round the building, and hymns and canticles occupied the night. Thus were executed most of those marvellous constructions of the middle ages, which bear in their conception and execution a character of unity and grandeur impressed upon them by the fervent piety of the founders. With such means at command, we may understand how those gigantic monuments, which seem to have required ages for their erection, may have been completed in a few years. But still we may doubt the assertion of the historians, who state that the construction of the Cathedral of Chartres, such as it now exists, occupied only eight years. It is not certainly of earlier date than the 12th century, and it is probably built over the constructions of Fulbert, of which only the vaults and other concealed parts might have remained. According to the testimony of other documents, it was 130 years before the edifice was consecrated.

In 1088, the princess Maud, widow of William, duke of Normandy, caused the central building to be covered with lead, for the entry to the nave, the grand portal, and what is now called the old steeple, were not finished till 1145. The other steeple was built of stone up to a certain height only, and was terminated by a pointed wooden spire, covered with lead. This was burnt by lightning in 1506, and the six bells suspended in it were melted. It was consequently determined to re-construct the spire in stone: Louis XII. gave 2000 livres towards defraying the expense, and indulgences were granted to persons who were willing to co-operate in the work. Jean Texier, an inhabitant of Chartres, was the architect on this occasion; the work was commenced in 1507 and finished in 1514. The foreman of the works received about six or seven sous a day, and the workmen only five.

This steeple, after having escaped another conflagration in 1674, was blown down in 1691; and was rebuilt in 1692 in the stone of Vernon, by Claude Augé, a sculptor of Lyons, four feet higher than it was before.

The dedication of the Cathedral took place on the 17th October, 1260, under the protection of the Holy Virgin: Peter de Mainey, seventy-sixth bishop of Chartres, officiated on the occasion.

Built upon the top of a hill, the cathedral rises majestically over the city; and the extraordinary height of the steeple makes it a most conspicuous object from a distance. The old steeple was 342 (French) feet in height, and the new one 378.

The exterior is decorated with a great number of statues and bas-reliefs, interesting memorials of the state of art in the 11th and 12th centuries; they are exceedingly well executed, so much so as to distinguish them from most of the works of that time. The same remark will apply to all the architectural ornaments of the building.

The south door is approached by a vast porch, of admirable style and construction; traces of painting and gilding still remain on the figures of this magnificent façade.

The north door is in a severer style. "This," says M. Jolimon, "is the richest in its details. The porch or peristyle is raised upon seven steps, and presents three grand arcades, which are surmounted by gables corresponding with the three entrances below, and sustained by piers and columns, which, as well as the vaulted roofs, are suitably adorned with statues and bas-reliefs."

The great statues fixed to the columns represent the patriarchs and the prophets of the Old Testament, whose names are written in Gothic character on the consoles which support them, and princes and persons of celebrity, among whom are Pierre de Mauclerc, duke of Brittany, and Alice his wife. The vaulted roofs of this peristyle are also richly adorned with groups of figures, representing scriptural scenes.

Above the porch is seen the upper part of the doorway, flanked by two small octagonal turrets, as well as by two large square towers, with flat roofs, and terminated by a gable, adorned with a figure of the Virgin. The central part above the doorway is entirely filled by a window, divided into five compartments, and surmounted by a beautiful rose of regular form.

Two grotesque figures are sculptured on two buttresses on the south side of the old tower, one of which represents a sow spinning, and the other an ass playing on the harp.

The inside of this building is no less beautiful and striking than its exterior. The subdued light which penetrates through the magnificent windows, produces on the mind of the spectator an almost magical effect.

The impressions produced by this temple are heightened in effect by the recollection of the memorable events of which it has been the scene. After the battle of Mons en Puelle, won by the Flemings on the 18th August, Philippe-le-Bel here offered to the Virgin the armour which he wore in the conflict. Philip of Valois came here to render thanks to the mother of our Saviour for the victory of Cassel, the 23rd of August 1328. And in this church the vanquisher of the League bowed his victorious brow.

This edifice is 396 French feet in length, 103 feet in breadth, and 106 feet in height to the roof. The windows of the nave, the transepts, and the chapels are adorned with figures of holy men, and a great number of subjects from the Bible, as well as with pictures representing the corporations of the arts and sciences which contributed by their doctrines or the labour of their hands to the construction of the splendid edifice.

In the circular parts of the windows are represented the kings,

dukes, and other persons of note who were benefactors to the edifice:—their shields are emblazoned, and they are mounted on richly caparisoned horses.

The screen of the choir is a very remarkable work; on it the principal events in the life of our Saviour and the Virgin Mary are represented in bas-relief, and the whole is framed in and surmounted by the most elegant ornaments.

The lobby, constructed before the choir in 1100, was destroyed in 1772, at which time some new embellishments were added to the building, which were unfortunately marked by the bad taste of that period, contrasting disadvantageously with the other parts of the edifice.

The underground vaults of this church are very extensive: and in that part of them situated under the choir, are thirteen chapels, one of which is dedicated to the Virgin.

On the 4th of June, 1836, a fire broke out in this fine cathedral, which destroyed the whole of the roofs, the wood-work of the steeples, and other parts of the building. The damage was estimated at about £40,000.

L. V.

ON THE MURAL PAINTINGS OF THE SCHOOL OF FINE ARTS, AT PARIS.

(*Continued from p.* 104.)

Taken altogether, this painting is the most important composition that has been executed by M. Delaroche. The hall in which it is placed, situated in the interior of the building, is a suitable termination to the skilful and ingenious arrangement of the rest of the edifice. It is a kind of semicircular amphitheatre, with a vaulted roof, and lighted from above through windows of stained glass. The coves are painted in gray-green and gold, and under the cornice which terminates them is a flat surface of wall, about 5 metres high and 25 wide. Upon this large semicircular space M. Delaroche has executed his paintings.

The place plainly indicated his subject,—the Apotheosis of Art. But it was not easy to carry out such a programme with that grandeur of style and composition which it called for. We are assured that M. Delaroche has employed many years of study in considering the general character of his work, in designing the grouping and the accessary details of his figures, and in forming the ensemble and harmonizing the tones, which are the most praiseworthy points of his work. Such devotion merits our warmest praise, and proves that he would have fully comprehended the high aims of monumental painting, if the execution of his work had been commensurate with the design.

But, independently of the manner in which it has been produced, the question arises, Has M. Delaroche realized his conceptions, or carried them out with a degree of taste that we can unreservedly applaud?

Behind the composition rises an Ionic peristyle, in the middle of which is a kind of niche or apsis; here are seated Ictinus, Apelles, and Phidias, representatives of the architecture, the painting, and the sculpture of the Greeks.

We will not stop to quarrel with M. Delaroche for the pre-eminence which he has accorded to Painting over Architecture, Apelles being placed in the centre of the composition, and in the presidential seat; but we are decidedly of opinion that this was not the place to bring so great an error prominently into notice. When, may we ask, was Architecture,—that great art from which all others spring,—subordinate to Painting? Did he wish to intimate that he considered Architecture of no account in this matter, and that his homage was due to Painting as a picturesque, and not as a monumental art? This would be indeed a bitter criticism on his own performance.

Upon the steps of the thrones occupied by these three great masters,—the glory of the age of Pericles and Alexander, are four figures, personifying the four principal epochs in the history of Art. These are, the Grecian, the Roman, the Middle Ages, and the Renaissance. Upon the first plan of this part of the painting is a fifth allegorical figure, meant doubtless for Glory, who, kneeling near a heap of crowns, is distributing them among the students of Art. On the right of the semicircle, which is divided into two parts by figures rather more raised than the rest, we see the Architects, groups of whom crowd the colonnade of the peristyle. Beyond them are the Painters of Design, and on the left the Sculptors and the Colourists. Thus there are five distinct groups, comprising seventy-five portraits or allegorical figures, but united in one ensemble with remarkable ability, without effort, and with an harmonious combination of tones and forms. The pictorial architecture is well combined with the real, without varying the lines of the building, or making the figures unduly prominent. A greater diversity of plan would have had the effect of carrying the eye out of the picture to the realities around it. The sky itself presents a certain uniformity of tones, which maintains the figures of the painters in the circular space, and has permitted the artist to impart to them a vigour of execution which brings them sufficiently near the eye of the spectator. The colouring, although rich, is devoid of any unpleasant dissonance; so that the first glance, which takes in only the harmony and the ensemble of the masses and the colouring, is highly favourable to M. Delaroche. This is doubtless one of the most essential qualities for architectural decoration; but the painter, having pleased his sight with a general view, must set himself carefully to consider whether the higher aims of art have been equally attended to.

Noticing as we proceed that M. Delaroche appears to have aimed at the grandeur and breadth of style which characterize fresco,—so much so, that some of our inexperienced diurnal critics have commented upon them as though executed in that style,—we must censure the undignified manner in which the greater part of the figures in this composition are treated. It is like a poem written in prose, as was well said on another occasion. The figures of Phidias and Ictinus in particular have this character, and are nothing but mere every-day models. They are drawn and draperied with correctness, but without any distinctive style. The same remark may be applied to the four figures which typify the epochs of art. As to the figure stooping down in the first compartment, it is doubtless skilfully handled; but there is little dignity in the attitude, or expression in the features. It has what we may call a *fashionable* air about it. However, this central portion of the painting is certainly better than the two sides which accompany it. There reigns within it a certain elevation of thought, which appears to have placed, with a fear of their being isolated in a sphere much too sublime, these timidly-imagined figures, represented as engaged in occupations and with a general bearing which makes them far enough removed from the ideal.

We now arrive at the portraits below those of the leading figures: First of all the Architects,—Philibert de Lorme, Baldazzar Péruzzi, Erwin de Steinbach, and Sansovino, who appear to be discoursing of their art. A second and larger group is composed of Robert de Luzarches, Palladio, Brunelleschi, Inigo Jones, Arnolfo di Lapo,

Pierre Lescot, Bramante, Mansart, and Vignole. We will say nothing on this somewhat singular selection of names, and especially in a French building. We rather refer to the value of these figures as portraits, since the artist appears to have attached the greatest importance to this point; but after all, it certainly would have been preferable to have elevated the character of these personages, to have depicted them nobly, to have made them think, as it were, instead of representing them in careless attitudes, and as engaged in trivial conversation.

We are sorry that M. Delaroche has drawn so carelessly from the stores furnished to him by the archives of engraving and portraiture. After the engravers Edelinck and Marc Antony, who are seen in profile in the distance, we arrive at the great Designers—Fiesble, Holbein, Lesueur, Orcagna, Sebastiano del Piombo, Albert Durer, Leonardo da Vinci, Dominichino, Fra Bartolomeo, Mantegna, Julio Romano, Raffaelle, Perugino, Mazaccio, Michael Angelo, Andrea del Sarto, Cimabue, Giotto, and Nicholas Poussin. The greater part of these artists are listening to Leonardi da Vinci, who is developing his theory of the Fine Arts. Michael Angelo, standing alone, appears wrapped in thought, and meditating on his own works. Poussin is casting an observing glance out of the crowd. Raffaelle is hardly the handsome youth painted with such taste and intellect by M. Ingres. That personage whose head is covered with a handkerchief recalls but little of Albert Durer, of whom so fine a portrait is in existence. M. Delaroche, indeed, pre-occupied with the imitation of the firm contours of fresco, has been negligent in modelling his figures; but with what care he has depicted the stuffs, and particularly the velvets! It is truly marvellous how he has succeeded in attaining so much harmony in his picture with so great a profusion of colours of so many shades.

To the left of the spectator are the Masters of Sculpture,—John of Bologna, Puget, Germain Pilou, Benvenuto Cellini, Jean Goujon, Bernard de Palissy, Donatello, Baccio-Bandinelli, Pisano, Benedetto-da-Mariano, Luca della Robbia, Pierre Bontemps, Peter Fischer. These artists are harmoniously arranged, but the expression of their faces conveys little interest. John of Bologna and Puget are chatting together; Germain Pilon, and Cellini are detached from the most numerous group. After the sculptors come the Colourists,—Corregio, Paul Veronese, Antony of Messina, Murillo, Van Eyck, Titian, Terburg, Rembrandt, Van der Helst, Rubens, Velasquez, Vandyke, Caravaggio, Bellini, Giorgione, Ruysdael, Paul Potter, Claude Lorraine, and Gaspar Poussin.

This part of the composition is more animated—there seems to be a warm dispute. John Van Eyck and Antony of Messina, who were the first to understand the secrets of oil-painting, are placed in front of a group, among whom Rubens is represented listening to the observations of Van Eyck on one side, and of Velasquez and Vandyke on the other. Other painters are joining in the conversation. Claude Lorraine, a little apart, is the principal person in a group of peasants. Rubens is easily recognised; the outline of his head is well drawn, but it wants vigour of expression; his satin dress too, savours somewhat of effeminacy. The admirable heads of Velasquez, Murillo, and Vandyke, are not better than that of Rubens. The flesh tints are of a dull colour, approaching in some to a brick red. The stuffs are painted with remarkable skill.

As to the design of this composition, which has been highly praised without adequate discernment, we may state that it is in general correct, savouring much of the Academy, but, although sufficiently firm in its outlines, the impression created by a first glance is more favourable than that produced by a closer examination. The apparent unity of the work disappears as soon as we begin to inquire what is the meaning of the whole: we cannot understand how these personages, so freely represented in their ordinary habitudes, and engaged in the every-day conversation of the world, can believe in the presence of those ideal figures, which throw away so much dignity for the purpose of presiding over them. On one side are silence and religious inspiration; on the other, are tumult, the movements of an ungovernable assembly, swayed by varied emotions, but unimportant enough, if we may judge by the contenances of the parties engaged. The costumes are historical, no doubt, but their union in this manner is a startling anachronism, as bad as a masked ball. But we must stop: our criticism is becoming too bitter—we are in danger of running in the other extreme, as blameable as those unskilful admirers who can see nothing equal to the work before us, except the School of Athens and the Apotheosis of Homer. M. Delaroche is a man of too much taste and talent to desire such eulogium. Though we ought to speak plainly with respect to an artist, who, well knowing his own strength, has a hold upon public sympathy, we ought also to render justice to the merits of his composition. M. Delaroche has got out of the rut of the old draughtsmen. He has skilfully arranged his figures, without having recourse to those masses of light and shade which were formerly so lavishly employed; and he has not fallen into the abuse of fore-shortened figures, floating draperies, and all the mythological follies to which some painters have had the bad taste to return.

Such as it is, with all its faults and merits, this mural painting of M. Delaroche is one of the best that has been produced for some time; and we must congratulate him on having joined the small band of artists who pursue this branch of art. M. Delaroche, who enjoys so direct an influence on the changeable and capricious taste of the public, may perhaps be able to render them familiar with works which, by their duration and their style, may outlive the conventional usages and fashions of a particular time. It seems that French art has a fear of sacrificing grace and elegance to manly and severe beauty. If we know how to admire the grand works of the Italian and Flemish masters, we allow ourselves to be too readily seduced by the prettinesses of Dutch composition; and it is with difficulty that we hold a middle course between the grand and the finished, between simple beauty and common reality. If the painting of M. Delaroche is not so satisfactory as we could have wished, it is because he has too implicitly followed the fashion of the national taste.

A. FILLIOUX.

MR. BARRY'S REPORT ON THE DECORATION OF THE NEW HOUSES OF PARLIAMENT,

ADDRESSED TO H. R. H. PRINCE ALBERT.

As presiding over her Majesty's commissioners for encouraging the fine arts in connection with the rebuilding of the new Houses of Parliament, I venture to address your royal highness, and, in compliance with the instruction of the commission, to offer the following suggestions relative to the internal finishings and decorations of the new Houses of Parliament, the completion of the exterior and local improvements, which are, in my opinion, necessary to give full effect to the new building; and by way of illustration of the remarks I have to make on these subjects, I beg to transmit the accompanying plan of the principal floor of the new building, a general plan of part of Westminster, in which the new building is shown in connection with various improvements proposed to be made in its locality, and two drawings relating to Westminster-bridge.

With reference to the interior of the new Houses of Parliament generally, I would suggest that the walls of the several halls, galleries, and corridors of approach, as well as the various public apartments throughout the building, should be decorated with paintings having reference to events in the history of the country; and that

those paintings should be placed in compartments formed by such a suitable arrangement of the architectural design of the interior as will best promote their effective union with the arts of sculpture and architecture. With this view, I should consider it to be of the utmost importance that the paintings should be wholly free from gloss on the surface, that they may be perfectly seen and fully understood from all points of view. That all other portions of the plain surfaces of the walls should be covered with suitable architectonic decoration, or diapered enrichment in colour, occasionally heightened with gold, and blended with armorial bearings, badges, cognisances, and other heraldic insignia, emblazoned in their proper colours. That such of the halls as are groined should have their vaults decorated in a similar manner, with the addition occasionally of subjects or works of art so interwoven with the diapered ground as not to disturb the harmony or the effect of the architectural composition. That such of the ceilings as are flat should be formed into compartments by moulded ribs, enriched with carved heraldic and Tudor decorations. That those ceilings should be relieved by positive colour and gilding, and occasionally by gold grounds with diaper enrichments, legends, and heraldic devices in colour. That the screens, pillars, corbels, niches, dressings of the windows, and other architectural decorations, should be painted to harmonize with the paintings and diapered decorations of the wall generally, and be occasionally relieved with positive colour and gilding. That the door-jambs and fire-places should be constructed of British marbles of suitable quality and colour, highly polished, and occasionally relieved by colour and gilding in their mouldings and sculptural enrichments.

That the floors of the several halls, galleries, and corridors, should be formed of encaustic tiles, bearing heraldic decorations and other enrichments in colours, laid in margins and compartments, in combination with polished British marbles; and that the same description of marbles should also be employed for the steps of the several staircases.

That the walls, to the height of from eight to ten feet, should be lined with oak framing, containing shields with armorial bearings emblasoned in their proper colours, and an oak seat should in all cases be placed against such framing. That the windows of the several halls, galleries, and corridors should be glazed doubly, for the purpose of tempering the light and preventing the direct rays of the sun from interfering with the effect of the internal decorations generally. For this purpose the outer glazing is proposed to be of ground glass, in single plates, and the inner glazing of an ornamental design in metal, filled with stained glass, bearing arms and other heraldic insignia in their proper colours; but so arranged as that the ground, which I should recommend to be of a warm yellowish tint, covered with a running foliage of diaper, and occasionally relieved by legends in black letter, should predominate, in order that so much light only may be excluded as may be thought desirable to do away with either a garish or cold effect upon the paintings and decorations generally. Practically, I consider that the double glazing will be of essential service in carrying out the system of warming and ventilating proposed to be adopted in the building generally; which system renders it unnecessary that the windows in those portions of the building above referred to should be made to open, so that all prejudicial effects upon the paintings and other decorations, which might be caused by the dampness and impurity of the atmosphere, and much practical inconvenience, and probably unsightliness in the means that would be necessary to adopt for opening and shutting casements would be avoided.

That, in order to promote the art of sculpture, and its effective union with painting and architecture, I would propose that in the halls, galleries, and corridors, statutes might be employed for the purpose of dividing the paintings on the walls. By this arrangement a rich effect of perspective, and a due subordination of the several arts to each other would be obtained. The statues suggested should, in my opinion, be of marble, of the colour of polished alabaster, and be raised upon lofty and suitable pedestals, placed close to the wall, in niches, surmounted by enriched canopies; but the niches should be shallow, so that the statutes may be as well seen laterally as in front.

The architectural decorations of these niches might be painted of such colours as will give the best effect to the adjoining paintings, being relieved in parts by positive colour and gilding; and the backs of them might be painted in dark colours, such as chocolate, crimson, or blue, or they might be of gold, for the purpose of giving effect to the statues.

Having thus described the views I entertain as to the character of the decorations of the interior generally, I now proceed to notice in detail the special decorations and arrangements which I would propose for the several halls, galleries, and principal apartments.

Westminster Hall.—I would propose that Westminster Hall, which is 239 feet long, 68 feet wide, and 90 feet high, should be made the depository, as in former times, for all trophies obtained in wars with foreign nations. These trophies might be so arranged above the paintings on the walls and in the roof as to have a very striking and interesting effect.

I would further suggest that pedestals, twenty in number, answering to the position of the principal ribs of the roof, should be placed so as to form a central avenue, 30 feet wide, from the north entrance door to St. Stephen's porch, for statutes of the most celebrated British statesmen, whose public services have been commemorated by monuments erected at the public expense, as well as for present and future statesmen whose services may be considered by Parliament to merit a similar tribute to their memories.

The statues (twenty-six in number) which have already been proposed to be placed against the walls, between the pictures, I would suggest should be those of naval and military commanders.

The subjects of the paintings on the walls, twenty-eight in number, 16 feet in length and 10 feet in height, might relate to the most splendid warlike achievements of English history, both by sea and land, which, as well as the statues that are proposed to divide them, might be arranged chronologically.

To give due effect to those suggested decorations, it is proposed that the light should be considerably increased by an enlargement of the dormer windows in the roof, by which also that extraordinary and beautiful piece of decorative carpentry of the 14th century may be seen to much greater advantage than has ever yet been the case.

This noble hall, certainly the most splendid in its style in the world, thus decorated by the union of painting, sculpture, and architecture, and aided by the arts of decoration as suggested, it is presumed would present a most striking appearance, and be an object of great national interest.

St. Stephen's Hall.—I would suggest that this hall, which will be 90 feet long, 39 feet wide, and 50 feet high, and have a stone-groined ceiling, should be appropriated to the reception of paintings, commemorative of great domestic events in British history, and statues of celebrated statesmen of past, present, and future times. The paintings may be ten in number, 15 feet long and 10 feet high, and 12 statues would be required as a frame to them. In the upper part of the hall, 30 niches will be provided for statues of eminent men of the naval, military, and civil services of the country.

The Central Hall.—This hall will be an octagon of 50 feet in diameter, and 50 feet high, covered with a groined ceiling in stone. As each side will be wholly occupied with windows, and arched openings of access, paintings cannot form any part of its decoration. It may, however, with good effect, be extensively decorated with sculpture. In the centre of the pavement might be placed a statue of her present Most Gracious Majesty, upon a rich pedestal of British marble, highly polished, and relieved in parts by gold and colour. The niches in the walls and screens might be filled with statutes of her Majesty's ancestors, in chronological order, even up to the period of the Heptarchy. In front of the eight clustered pillars in the angles of the hall, might be placed, with good effect, sedent statues of some of the great lawgivers of antiquity.

The Victoria Gallery.—This gallery will be 130 feet long, 45 feet wide, and 50 feet high, with a flat ceiling, and will admit of both paintings and sculpture. The subjects of the paintings on the walls, 16 in number, which may be 12 feet long and 10 feet high, might relate to some of the most remarkable royal pageants of British history or other appropriate subjects. Statues of her present Most Gracious Majesty might fill the central niches at the ends of the hall, and the other niches, as well as the pedestals between the paintings, might be occupied by statues of her Majesty's ancestors. These statues might, with good effect, be of bronze, either partially or wholly gilt.

Corridors of Access throughout the Building.—The principal corridors of access to the various apartments of the building will be 12 feet wide, their ceilings will be flat, and they will be generally lighted from windows near the ceiling. The walls may be decorated with portraits as well as paintings, illustrative of some of the most remarkable events in the history of the country, or in the lives of its most eminent personages. For this purpose about 2,600 feet in length of wall, by a height of about seven feet, may be appropriated on the principal floor; 900 feet in length, by a height of about seven feet, on the one-pair floor; and about 400 feet, by the same height, on the two-pair floor. These paintings may be divided into subjects at pleasure, by margins or borders of architectonic decoration in accordance with the style of the building.

The House of Lords.—This house will be 93 feet long, 45 feet wide, and 50 feet high, will have a flat ceiling in panels. As the fittings for the accommodation required for the business of the house,

together with the windows, which are necessary for duly lighting it, leave little space of plain wall, paintings cannot, with good effect, form any part of its decoration. Niches, however, will be provided, which might be filled with statues of royal personages. The architectural details of the ceiling may be enriched and relieved with gold and colour, and the windows filled with stained glass as before described. The whole of the fittings are proposed to be of oak, with appropriate carvings. The throne will be highly enriched and relieved by colour and gilding, and the back lined with cloth of gold, containing the royal arms emblasoned in colours.

The House of Commons.—This house will be 83 feet long, 46 feet wide, and 50 feet high, and will have a flat ceiling. It is proposed to be finished in the same style as the House of Lords, but with less enrichment, and less of colour and gold in its decorations. The nature of its design, and the extent of its fittings for the accommodation required, will not admit of either painting or sculpture.

The Queen's Robing-Room.—This room will be 38 feet long, 35 feet wide, and 20 feet high, and have a flat ceiling in panels, richly moulded and carved, and relieved with gold and colour. The ground of the panels of the ceiling is proposed to be of gold, covered with a diaper enrichment, and blended with legends, genealogical devices, badges, cognisances, and other heraldic insignia, and in colour.

The wall-fittings of the room are proposed to be of oak, richly carved and moulded, and enriched with heraldic and other decorations in positive colour, relieved with gold. Compartments will be formed in the wall-framing, which might be filled with paintings referring to events in British history in which the Sovereign has personally taken a conspicuous part, or with other appropriate subjects.

The Anti-Room or Guard-Room.—This room which adjoins the Queen's robing room, will be 38 feet by 38 feet, and 20 feet high. The ceiling will be of oak, with characteristic decorations. Oak framing, eight feet high, with heraldic decorations, and a seat at the foot of it, will line the room. The walls are proposed to be covered with representations of battle-scenes and pageants of English history, in which an opportunity will be afforded of displaying the warlike costumes of its several periods.

The Conference Hall.—This hall, which is in the centre of the front towards the river, will be 54 feet long, 28 feet wide, and 20 feet high, and will have a flat ceiling. The walls are proposed to be lined with oak framing to a height of about six feet, above which they might be covered with paintings representing celebrated state trials, and extraordinary sittings of Parliament, conferences, &c.

As to the apartments appropriated to the private and public uses of each house.—These rooms consist of libraries, refreshment rooms, robing rooms, state officers' rooms, and committee rooms.

Nine rooms are appropriated to libraries, six of which are 50 feet long, and 28 feet wide; two are 33 feet long, and 28 feet wide; and one is 32 feet long and 23 feet wide. The refreshment rooms are four in number, of which one is 60 feet long and 18 feet wide; two are 28 feet long and 18 feet wide; and one is 34 feet long and 18 feet wide. The robing rooms for the archbishops and bishops are three in number, of the respective sizes of 30 feet by 20 feet, 20 feet square and 16 feet square. The robing and other rooms for state officers are seventeen in number, averaging in size about 24 feet by 18 feet. The committee rooms are thirty-five in number. On the principal floor, five of them will be 37 feet long by 28 feet wide; two 35 feet by 26 feet; and one 32 feet by 23 feet. On the one-pair floor, two will be 42 feet long and 33 feet wide; one, 54 feet by 28 feet; four 36 feet by 28 feet; ten, 34 feet by 28 feet; and two, 34 feet by 22 feet; and on the two-pair floor the number will be eight, averaging in size 28 feet by 20 feet. The whole of these rooms are about 20 feet in height, with the exception of those on the two-pair floor, which will be about 14 feet high, and will be lighted by windows of the usual height from the floor.

The ceilings will be flat, and formed into panels by moulded and carved ribs, relieved by characteristic and suitable carvings.

The floors are to be of oak, with borders and inlays.

The fire places and door jambs are proposed to be of British marbles, highly polished. The doors, frontispieces, linings of walls, and fittings, will also be of oak. In some of the rooms, it is proposed that the wall framing should be carried to the height of six or eight feet, in others that it should be of the full height of the room, and with panels for paintings, portraits, &c.

The plain surfaces of the walls might be covered with paintings of historical events, and the panels in the wainscoting might contain portraits of celebrated personages in British history.

The architectural details, both in stone and plaster, might be painted in positive colours, occasionally relieved with gilding; and the armorial bearings, badges, and other heraldic insignia which will enrich the wood-framing, might also be relieved with gold and colour.

The Speaker's Residence.—This residence, being designed for state purposes, might also be adorned with paintings. The style of its finishings, fittings, and decorations will be in accordance with the best examples of the Tudor period.

Its principal rooms for the purposes of state are as follows:—a reception-room, 34 feet by 23 feet; a library, 34 feet by 23 feet; a dining-room, 45 feet by 24 feet; a drawing-room, 38 feet by 22 feet; and a corridor of communication, 8 feet wide, surrounding an internal court.

With respect to any further encouragement of the fine arts in the exterior of the building, I am not aware of any opportunities that offer, as arrangements have already been made for all the architectonic or conventional sculpture that will be required to adorn the several elevations. Equestrian statues of sovereigns in bronze might, however, be placed with considerable effect in the proposed quadrangle of New Palace-yard, the Speaker's quadrangle, and the royal court.

I have now described, in general terms, the whole of those portions of the building that might, I think, with propriety and effect, be adorned with works of art, and the arts of decoration; but in making the several suggestions which have occurred to me, I should wish it to be understood that I have merely stated my own views on the subject, as far as I have hitherto been able to consider it in its general bearings, and with a view to show how the objects for which the commission has been established may, if desired, be carried out in the decorations of the new building to their greatest extent. I should not, however, wish to be strictly confined in all cases to the adoption even of my own suggestions, as upon a more mature consideration of the subject in detail hereafter, when the shell of the building is completed, I may be induced to vary and modify some of the views which I entertain at present, and which, I fear, I have but imperfectly communicated in this paper.

As to the completion of the exterior.—It has ever been considered by me a great defect in my design for the new Houses of Parliament, that it does not comprise a front of a sufficient length towards the Abbey, particularly as the building will be better and more generally seen on that side than any other. This was impossible, owing to the broken outline of the site with which I had to deal. I propose, therefore, that an addition should be made to the building for the purpose of enclosing New Palace-yard, and thus of obtaining the desired front. This addition would be in accordance with the plan of the ancient palace of Westminster, in which the hall was formerly placed in a quadruple, where, in consequence of its low level, it must have been seen and approached, as it would be, under such circumstances, to the best advantage. The proposed addition would, in my opinion, be of considerable importance as regards the increased accommodation and convenience that it would afford, in addition to what is already provided for in the new building as hitherto proposed.

It has long been a subject of serious complaint and reproach, that the present law courts are most inconveniently restricted in their arrangements and accommodation. If it should be determined to retain the courts at Westminster, the proposed addition would admit of the means of removing this cause of complaint; it would also afford accommodation for places of refreshment for the public, for which no provision has been made in the new building, also for royal commissions and other occasional purposes required by Government, and now hired most inconveniently, in various parts of the town, at a considerable amount of rental; or for such of the government offices as may, without inconvenience, be detached from the rest, such as, for instance, the office of woods, or for a record office, and chambers or residences for public officers. It will also afford the opportunity of making an imposing principal entrance to the entire edifice at the angle of Bridge-street and St. Margaret-street—a feature which is at present required, and which would add considerably, not only to the effect of the building, but also to its security in times of public commotion.

Of the several local improvements suggested, none, in my opinion, is of greater or more pressing importance than that which I have to suggest in respect to Westminster bridge. The anomaly of the size, outline, and character of that bridge, considered, as it ever must be from its proximity, as an adjunct to the new Houses of Parliament, must have forcibly struck every one who has passed over or under it since the new building has risen into importance; and the steep and dangerous declivities of the roadway, as well as its want of width for the traffic that passes over it, have constantly been a subject of public complaint.

In order, therefore, to remove these serious objections, I propose that the superstructure of the bridge should be rebuilt upon the old foundations, which are now in course of being repaired and extended under the able superintendence of Messrs. Walker and Burgess. As it is, in my opinion, of the utmost importance, both as regards the effect of the new Houses of Parliament, when viewed from the bridge, and the convenience of the public in passing over it, that the roadway should be made on the lowest possible level, I would recommend that the form of the arches of the new bridge should be pointed, by which great facility would be afforded for accomplishing that very important object, namely, by materially reducing the thickness of the crown of the arches within what is considered necessary for arches of the circular form. I am induced also to recommend this form of arch on account of another very important practical advantage which it offers, namely, the elevation of its springing above the level of high water, by which the water-way through the bridge will be the same at all times of tide; whereas at present the spandrils of the arches offer an impediment to the water-way at high water, nearly equal to 1-20th of its sectional area, occasioning rapid currents with a considerable fall, and sometimes much danger to craft in passing through the bridge, under the influence of high winds. I consider it also of the greatest importance in an artistic point of view, not only that the bridge should be materially lowered, but that it should be made to accord with the new Houses of Parliament, in order that, both in composition as well as style, the *ensemble* should be harmonious and effective. Upon a rough estimate which I have formed of the cost of the new super structure, I am satisfied it could be erected for about £120,000 beyond the cost it will be necessary to incur to carry out Messrs. Walker and Burgess's design for widening the present bridge to the extent proposed.

As there would, doubtless, be serious objections to a public road upon the embankment on the north side of the river, I confine my observations to the southern side, where, if a road could be obtained, it would afford a succession of fine views of London, and the best situation for views of the principal front of the new Houses of Parliament. Having maturely considered the subject, I think it would be practicable to obtain a public road of ample width upon arches, from the termini of the South-Eastern and Dover and the Brighton Railroads at the foot of London-bridge to the terminus of the South-Western Railway at Vauxhall.

The road might be raised upon arches to a level that would coincide with the levels of the roadway of the several bridges which it would intersect, by which means the water-side frontages of the several wharfs need not to be interfered with in any material degree; indeed, the extent of such frontages might, by the means of docks of convenient form and size, be very considerably increased, and the archways might, to a great extent, be appropriated, if desired, to warehouses and other purposes of trade. By extending the archways to a sufficient depth to the south of this road, a frontage for building might also be obtained, particularly opposite Privy-gardens and the new Houses of Parliament, where, if the houses were designed in masses, with reference to architectural effect, they would form an agreeable and striking view from the north side of the river, and effectually screen the present low and mean display of unpicturesque buildings on the Surrey side. The proposed houses, from being raised to a considerable elevation, would have a fine command of the river and the principal public buildings of the metropolis, and having, in addition to these advantages, a southern aspect, would form very agreeable residences, such as would probably be eagerly sought for by the owners of adjoining wharfs, either for their own occupation or that of their principal agents. Taking into consideration the private accommodation to the several wharfs, and the value of the new building frontage, the proposed work would probably yield a very considerable return for the capital expended upon it, and, when effected, would not only form one of the most striking improvements of an ornamental character of which the metropolis is susceptible, but would materially conduce to the convenience, the comfort, and recreation of the public. It would also perhaps render unnecessary the line of road that has been projected from the termini of the railroads at the foot of London-bridge, through Southwark to the foot of Westminster-bridge, for the convenience of the west end of the town, as the distance to that part of London would be materially shortened by taking the proposed embankment road, and passing over Waterloo-bridge.

Old Palace-yard is proposed to be considerably increased in size by the demolition of the houses which now occupy that site, as well as the houses on both sides of Abingdon-street, by which means a fine area for the convenience of state processions, and the carriages of peers and others attending the House of Lords, as well as a spacious landing-place adjoining the river, would be obtained. The Victoria Tower, as well as the south and west fronts of the building would thus be displayed to the best advantage. The Chapter house would be laid open to public view, and if restored, would form a striking feature in conjunction with the Abbey; and a considerable extent of new building frontage that would be obtained by this alteration might be occupied by houses of importance, in a style of architecture in harmony with the Abbey and the new Houses of Parliament, by which a grand and imposing effect as a whole would be produced. As one means of improving the approaches I propose that the noble width of street at Whitehall should be extended southwards by the removal of the houses between Parliament-street and King-street, by which the Abbey would be wholly exposed to view as far as Whitehall Chapel. The houses on the north side of King-street should be removed for the purpose of substituting houses or public buildings—if required, of an improving style of architecture.

Millbank-street is proposed to be widened and improved in order to make it a convenient and effective approach from Millbank-road to the Victoria Tower and Old Palace-yard. Tothill-street is also proposed to be widened and improved in order that it may be made an equally convenient and striking approach to the Abbey, the Houses of Parliament and Whitehall from the west end of the town. St. Margaret's Church, if suffered to remain in its present position, should be improved in its external decoration, in order that it may not disgrace, as it now does, the noble pile of the Abbey, which rises above it.

A SKETCH OF THE LIFE OF PALLADIO, AND A DESCRIPTION OF HIS WORKS.

[The following essay is a free translation from the Italian. Many of the opinions expressed in this memoir, common to the period in which the author lived, have long ceased to be entertained by those who have thought most acutely and judiciously on the subject; but so great was the revolution in art produced by Palladio and his admirers, that it cannot be uninteresting nor uninstructive to refer to the opinions of his school. The introductory remarks are trite and common-place, and have been reiterated by almost every modern author who has written a treatise on architecture.—Transl.]

Architecture, which has a pre-eminent station among those arts that are most useful, most noble, and most applicable to the convenience of mankind, drew its principles from times so remote from our own, that the period of its birth remains in great uncertainty and obscurity. The origin attributed by Vitruvius (lib. ii. cap. i.) to this art appears very improbable; but it has been accepted by writers of sound judgment and acute perception, and his statements, which appear to be rather fabulous inventions than historical facts, have been received as though they were worthy of implicit confidence.

When we take a retrospective examination of history, to discover the rise of Architecture, we are convinced that the art is almost contemporaneous with creation itself. Men discovered the necessity of protecting themselves from the effects of atmospheric changes soon after the period which gave birth to the species. The dens, caves, and grottos, the works of nature, could not give shelter to all. Necessity rendered them industrious, and taking the natural abodes as models, they built artificial shelters. In proportion as the early inhabitants of the earth multiplied, and spread over its surface, forming themselves into societies in places favourable to their future existence, they were compelled to increase the number of their dwelling-places, to defend themselves from the heat of the sun, the attack of wild beasts, and the inclemency of the seasons, to all of which sources of annoyance and danger they were too frequently exposed. The study and practice of the art of construction increased in proportion to their numerous wants. At first they only sought to protect themselves from danger or inconvenience; afterwards they desired some comforts, and at last they endeavoured to give symmetry and decoration to their works.

A design by Palladio

The first habitations of man were simple in their workmanship, and constructed of common and rude materials. Cottages and huts, covered with cane and straw, enclosed with walls of rushes and branches of trees plastered with clay, and supported by rough timbers fixed perpendicularly in the ground, were the most simple productions of that necessity which gave birth to Architecture. Without losing ourselves in the obscurity of the remote ages, in a useless attempt to discover a rough sketch of the first inventions, we may find examples of a primitive style of building in the wretched huts occupied by some of our own countrymen.

Architecture, though born of such low parentage, was nourished by industrious necessity, and continued to acquire strength and elegance by the attentions of men loving their own convenience, and studious of its gratification. From one invention they passed easily to another: the column, base, and cornice were invented, to unite solidity and ornament by their addition to the original fabric, and new members, combining happily with those already in existence, were successively formed, to give beauty and harmony to the whole. By such means was established all that in succeeding ages adorned and ennobled the magnificent temples of Diana at Ephesus, of Apollo at Delphos, of Jupiter on the Capitoline Mount, the Pantheon at Rome, that gigantic edifice the famous cathedral of St. Peter's at Rome, and that of St. Paul's in London, the celebrated Louvre of Paris, and all the most elegant and graceful structures which Architecture, improved, and raised to an art, brought to the highest degree of perfection.

By what progression Architecture advanced in the primitive ages among different nations before it acquired the superiority it received in the hands of the Greeks and Romans, is not easily to be traced. Many ages must certainly have passed between the erection of the primitive rude cottage, and that of the symmetrious palace, ornamental, regular, and elegant. Before Architecture flourished and became great in the buildings of Greece and Latium, Nineveh and Babylon had their towers, palaces, and bridges, and the fruitful Egypt boasted of its gigantic structures, and to this day its haughty pyramids and other marvellous monuments of a well-designed architecture remain. The Greeks, who were among the first to give surprising proofs of genius and good taste, in the sciences as well as in the fine arts, distinguished themselves, at a late period of their history, in Architecture. That nation is indebted for the progress it made to the genius of a Pericles, and the greatness of an Alexander: the former knew how to select with taste and discernment the most convenient and judicious forms of architecture; the latter was able to apply the invention and design to new and sumptuous buildings of every kind.

From Greece the art passed to Rome, and under the empire of the great Augustus it flourished in all its vigour, favoured and protected by the splendour and liberality of powerful patrons. If the history of those times and of Vitruvius, the prince of architects, had failed to inform us of this fact, the venerable remains of the aqueducts, fountains, baths, porticos, amphitheatres, arches, and temples of that most fortunate age, erected by the magnificence of the Romans, could not have left us in doubt. Here then we may see Architecture, strengthened by the luxury and prodigality of the rich and noble, raised to perfection in Rome in the age of Cæsar Augustus,—an age in which literature and the fine arts alike flourished,—the age which produced Vitruvius, who, having collected all the most valuable details of the architecture of the Greeks, knew how to illustrate and systematize the principles of the art, and with a profound knowledge combined that unspotted honesty which distinguishes a great mind from the vulgar and plebeian.

This art, so useful to man, and so decorous to civilized nations, and better adapted than any other to exhibit their greatness and magnificence, flourished in Rome for many ages. But Architecture, although more cultivated than any other fine art, was not exempt from the fatal changes suffered by the sciences and arts from the barbarism of succeeding ages.

Architecture for a long time remained in an infantine state, and slowly advanced to manhood; but having acquired perfection, was rapidly, indeed almost instantaneously, by a singular combination of events, brought into decay and old age. In the reign of Constantine it lost all its elegance and beauty, and was subsequently so strangely disfigured that it ultimately took the barbarous features of that style called Gothic or German. Nor can we imagine what would have been the depth of its degradation if Brunelleschi, a Florentine architect, with courage proportioned to the undertaking, had not arrested the course of those false ideas which had taken possession of all minds.

Encouraged by the example of a man so wise and judicious, other architects who succeeded Brunelleschi undertook to destroy the monstrosities introduced by barbarism and licence, and to restore the art to its original simplicity, beauty, and dignity.

Bramante, Falconetto, Sanmicheli, Bonarroti, Sansovino, Vignola, Palladio, and Scammozzi, all of whom flourished within a century and a half, with many other worthy professors of architecture, who, having studied the beauties of ancient art, and varied their designs with great taste and discernment, adorned Italy with elegant and well-constructed buildings, which are amongst the most beautiful models of architecture, and have preserved to their country the title she has so long enjoyed,—the Mistress of the Fine Arts.

But the glory of bringing this art to perfection, and of preserving it from the licence of capricious innovators and the influence of bad taste, was reserved for the sublime genius of Palladio; a merit universally granted to him by all discerning lovers of the art. It was for this reason that Count Algarotti justly called him the Raphael of Architecture. The illustrious author of the Lives of the Architects, placing them in the order of their intelligence and taste, gives the first place to Palladio; and the learned Temanza, himself an excellent architect, speaks of him as one of the luminaries of the art.

It is my object to explain by what course of study and in what manner Palladio raised himself above the sphere of all his contemporaries, and to show how he, by his studies, contributed to the restoration and improvement of that art which is most useful to society. This was well done in a work published by Temanza, who collected the designs of Palladio, and of his memoir this is in some respects a compendium.

Palladio was born in Vicenza in the year 1518; from his youth he delighted greatly in architecture, as he informs us in his dedicatory letter to his first work; and in the preface, speaking more particularly of his genius, he says, that from natural inclination he was led to apply himself from his earliest years to the study of architecture, and took Vitruvius for his guide and master. This casual allusion to his early history destroys the belief founded on tradition that he passed his youth in the humble and laborious occupation of a bricklayer's labourer. The treatise of Vitruvius being a work unintelligible to those who are destitute of learning and of natural science, Temanza believes that he must at the age of twenty-three have possessed at least the elements of geometry and of a liberal education, which are the steps to celebrity in architecture.

It has been believed, and some persons are still of the same opinion, that Palladio was instructed in architecture by Giangiorgio Trissino.

But Temanza and Count Alessandro Pompei, a gentleman as celebrated for his rare acquirements as for the nobility of his birth, are of opinion that Palladio never stood in this relation to Trissino, for in the preface to the first book of his Treatise on Architecture, he makes honourable mention of Trissino without alluding to the circumstance of his having been his pupil. But if Trissino was not absolutely his preceptor, it is well known that by his encouragement and example he inspired him with great ardour in the study of the fine arts, in which he afterwards distinguished himself in a greater degree than any of his contemporaries.

Palladio knew that to become an architect it was not enough to study the authors who have written on the art, but that it was equally necessary to see the application of their rules and precepts in practice. For this purpose he travelled expressly in different parts of Italy and in other countries, and stayed for some time in Rome, where many celebrated ruins and illustrious monuments of ancient architecture still remain. These models, far more instructive than the most accurate and minute descriptions of the compilers of antiquarian works, became his study, his school, and his books.

Palladio did not superficially examine these wonderful works like many who are satisfied with being architects in name rather than in reality. He conducted his researches with diligence, availing himself of every means that was presented, and he succeeded in restoring and exhibiting all their parts, even when mutilated and in ruins. He examined even the foundations of these buildings, that he might determine the mode in which they were constructed; and he possessed himself of the original idea or perception of the artists who designed them, and all the minutiæ of arrangement and ornament. It was by an extremely scrupulous regard to every circumstance in these examinations that he afterwards secured his own celebrity, and especially in the arrangement of the plans of his edifices.

In the year 1547, when he was twenty-nine years of age, Palladio was studying at Rome, and in the same year he returned to his own country with a rich store of available knowledge, and soon after highly distinguished himself in his art. His fame soon spread from Vicenza, and he was immediately employed in the erection of several important buildings. In the public palace of Udini, erected in his time, there are some parts which, according to Sig. Tementa, a great connoisseur in Palladian architecture, exhibit some well-expressed traces of the style of this artist.

The best opportunity that was given to Palladio after his return from Rome to exhibit his profound acquaintance with his art, derived from the study of the Roman buildings, was a commission from his country to design porticos to the Basilica of Vicenza. In the same manner he was chosen to prepare drawings for the public hall at Venice. Whether the porticos of this building were in ruins, or whether the government wished to substitute a composition of arches in pure and elegant taste in the place of the Gothic structure, it is certain that Palladio and other architects were ordered to present designs, and that of Palladio being chosen by the senators, the work was immediately commenced. The elegance of the orders, the grandeur and magnificence of the logia, and the suitable materials employed in the construction would have united in giving such a superior character to this edifice, that it would have served not only as an ornament to a provincial town, but have been a great work in a metropolis; neither would it have lost in merit nor in the nobility of its character if it had been placed in comparison with the most elegant and lordly structures of ancient Rome. But the commissions given to the young architect in this work were not completed.

In consequence of his great celebrity, Palladio was called to Rome for the purpose of erecting the church of St. Peter. But his misfortune at this time was the means of affording him the finest possible opportunity of establishing his reputation. On his arrival in Rome, he found that the Pope, Paul III., was dead, and the whole city was in commotion and disorder. It is probable that Trissino, one of his most zealous patrons, who resided for some time at Rome, and enjoyed the confidence of the pontiff, had procured him the honour, after the death of Antonio di S. Gallo, of being selected as the future architect of St. Peter's church. The death of the Pope must have been a great disappointment to Palladio, and not less afflicting the loss of Trissino, his patron, who died in Rome in the year 1550. But Palladio did not fail to avail himself of the opportunity of again examining and measuring the greater part of the ancient edifices in and near Rome,—the theatres, amphitheatres, triumphal arches, temples, tombs, thermes, and other celebrated structures. It was perhaps at this time he had the satisfaction of seeing some of his own designs executed in the imperial capital. But this was not the last occasion of his visiting Rome to study the ancient buildings; for, according to Giraldo, he returned for the fifth time with some gentlemen of Venice, his friends, and again, with the same diligence and zeal, applied himself to the measurement of the Roman antiquities.

Palladio having had opportunities, during his residence at Rome, of making himself acquainted with the finest relics of antiquity, and having minutely examined and sketched them, possessed all the information necessary to compose a work on Roman architecture. This book was written in 1554, and during the year two editions were published, one at Rome and another at Venice,—a sufficient proof that the book, although it contained only a brief account of the Roman antiquities, was favourably received by the public.

Hitherto we have watched Palladio in his study of ancient buildings. We have seen him richly furnished with all the knowledge necessary for the successful practice of an architect, full of imagination, and with a store of novel ideas collected from ancient works, with an excellent discernment and an appreciation of all the elements of beauty, thoroughly acquainted with the elements of his art; and we have been struck with the originality of some of his productions. It is now time that we should watch the genius of the man in his power of invention and creation. Opportunities were not wanting to kindle the fire of his invention,—opportunities without which genius, however intense, must for ever remain hidden.

Settled at last in his own country, his fellow-citizens, who well knew the worth and merit of the new architect that had appeared among them, contended for the honour of devising new buildings to be erected by Palladio. By this means he was offered a vast field for the exercise of his rare genius in the invention of new forms for buildings, but always restraining himself by the sound principles of art, and soon acquired that skill, without which theory is unable to give expression and life to the preconceived idea.

Being thus occupied for many successive years, in the service of his fellow-citizens as well as in that of foreigners, our architect produced numerous buildings of different kinds, so varied, so well designed, so elegant, so majestic, alike pleasing in their form and ornaments, that they excited the wonder of all lovers of the art, and procured for him the honourable title of the Father of Architecture.

Oppressed by the multiplicity of his studies, and the assiduity with which he pursued them, and not less by the untimely death of his two children, he was attacked, in a delicate state of health, by a pernicious disease which proved fatal. He died in 1580, in the 62nd year of his age, lamented by all his countrymen, who were fully conscious of the loss they sustained in the death of a man of the greatest

merit. The Olympic, an academy for whom he had designed a theatre, well known and much admired, and who were justly proud of having had him among their members, publicly testified its grief for the loss it had sustained, by accompanying the body to the grave, and by delivering several discourses in his praise.

(*To be continued.*)

REPORT ON THE BAR OF NEWHAVEN HARBOUR.

BY JAMES WALKER, ESQ., C.E.

March, 1843.

SIR,

THE object of the application to me is given generally in the notes I had the honour to receive from the Earl of Chichester, as Chairman of the Commissioners and Trustees of Newhaven Harbour and Piers, and more particularly in your letter to me of the 18th May, 1842.

This letter states, 'that the mouth of the harbour is occasionally, during strong westerly winds, partially blocked up by the shingle or beach drifting from the westward, which it has been suggested might be prevented by erecting a groyne to the westward of the western pier. The Commissioners are, however (you inform me), anxious to obtain my opinion and advice previously, as to the propriety of it.' You do not in your letter refer to the difficulty of entering the harbour during strong westerly winds from the heavy seas upon the west or inside of the eastern pier, to which my attention has been particularly given, as it is, I believe, a still more troublesome evil than the shingle. Some correspondence also took place with you and the harbour-master, Mr. Stevens. On the 7th October I arrived at Newhaven, and at an early hour next morning I proceeded with Mr. Stevens on the survey. The tide and weather were very favourable for my object. In the course of the forenoon I was joined by several Commissioners, with whom, after again surveying the piers and harbour, I crossed the harbour, reviewed the bank and groynes on the east side, towards Seaford; also, the back-water or pool of Mr. Catt's mill, and returned to Newhaven. In the afternoon I accompanied you to Lewes, where I had a short conference with Lord Chichester.

Having since received from you the reports of engineers who had been previously consulted, I have perused the same, and thus, as well as by a correspondence with Mr. Stevens, have endeavoured to bring in aid the former state of the harbour, the works done of late years, their effect, and the present state of the entrance, in considering the question which has been referred to me.

Having (as a member of the commission appointed by government to report on harbours of refuge,) visited Newhaven in 1839, having then examined Lieutenant Franklin, Mr. Stevens, and others, the notes of which evidence are in my possession, and having the surveys made by Captain Bullock for the use of that commission, the subject was not altogether new to me. I have, of course, taken advantage of the above documents to assist my present consideration.

My inquiry has also been much facilitated through some of the principal improvements having been made during the time (12 years) Mr. Stevens has been harbour-master.

I know no harbour exposed to the sea, which, judging from the statements and accounts I have received, has improved so much and at so little expense as Newhaven. Its natural facilities have assisted the efforts and management of the Commissioners and their zealous harbour-master.

During the last twenty-three years, the harbour and its entrance have deepened seven to eight feet. In 1823, Mr. Whidby reported that the interior of the harbour was little more than a ditch, although there was a depth at the entrance of ten to fourteen feet at high water of neap tides. In 1839, Mr. Ellman stated to the Commissioners for South-Eastern Harbours, that in 1806 (only 37 years since), vessels drawing nine feet and a half used to unload their cargoes before venturing into the harbour. Now, vessels with full cargoes, drawing from thirteen to fourteen feet water, come in at the lowest neaps, if the sea be smooth; and at spring tides the depth is from three to five feet additional; and the other improvements have been effected chiefly by clearing the harbour, and the river Ouse above the harbour, of shoals and impediments, so that the tidal water is admitted more freely, and returns in greater quantity and force than formerly; and partly by the extension of the east pier, which has confined the outgoing current to act upon the bottom, and drive the shingle into deep water. No harbour upon the south-east coast, as low as Portsmouth, has so good a natural backwater, or is more capable of still further improvement, were the funds ample.

It is not necessary for my purpose to particularize further back than about twenty years since. Mr. Jessop, in 1819, reported "that the water which was discharged from the harbour expanded itself too soon to the eastward, and that the current was diverted before it reached the extremity of the western pier; that the consequence was, a considerable deposit of beach within the pier;" to relieve which he recommended "a row of sheet piles to be continued from the inner end of the eastern pier, parallel to, and nearly to the extent of, the western pier." The tops to be just above the level of low water of neap tides. Mr. Jessop's objection to the piles being higher was, that they would then be in the way of vessels, which, in warping or working up to the entrance, might be carried to leeward by the tide setting across the entrance or driven against the leeward pier, after getting between the piers.

This dwarf piling recommended by Mr. Jessop was done, and no doubt produced a partial good; accordingly, Mr. Jessop reports, in 1821, that the circuitous channel from the eastward, which had before formed the entrance to the harbour, appeared "to be permanently removed by giving the effluent water a more confined channel beyond the termination of the western pier." The effect, however, could be but partial, as at the time of the strongest ebb, say almost half ebb, the water that was above low water was still allowed to expand itself to the eastward. In 1831, Mr. Cubitt recommended the extension of the east pier to its full height, to be substituted for the dwarf piling, in order "to assist the scour and removal of shingle from within the west pier, and to lessen the action of the surf upon the bank just at the back of the east pier, which he describes as being then the most vulnerable part of the beach." In 1835, the same recommendation was repeated by Mr. Cubitt, the plans and models prepared by Mr. Stevens were approved of, and the work was recommended to be done under Mr. Stevens' superintendence. In compliance with this recommendation, an extension of the east pier, 130 feet in length, was made in 1838, and as far as the anticipated effects went, it has been successful, but it has been attended by an evil for which it is one of the objects of the present inquiry to find a remedy.

The harbour, from its embayed position and the projection of Seaford cliff, may be considered sheltered from all winds between W.N.W. round by north to south-east, being 18 points of the compass, or 202°. From the north-west to south-west, six points, or 67° only, it is open to be attacked, but the points between west and W.S.W., which are right up the British channel, are the most tormenting winds for ships entering the harbour, and they are frequent winds upon the south coast.

Now, it will be seen by reference to a plan of the entrance, that as the direction across the pier heads is only 9°, or less than one point south of east, the west pier forms a shelter to the east pier from all winds north of west, but that the inside of the extended part of the east pier is quite open to be struck by the heavy seas between west and south-west, being four points, or 45°. Previous to that extension, these seas ran up, and were spent upon the beach at the back of the east pier; they now rebound from the face of the east pier into the entrance, so as to produce agitation and to confuse and stop the way of ships entering, by causing them to pitch and roll about, while the sea beating over their decks, confuses and lessens the efficiency of the crew.

That something, therefore, is wanted to break off or split and reduce these seas, before they reach the entrance, is evident; and the same winds bring shingle round the end of the west pier and lay it up in the entrance.

I have now to report my opinion of the two evils, the first being, as I have already said, the greater. Three different ways of improvement present themselves, viz:—

Firstly, the extension of the west pier 130 feet in length, made solid, or nearly so, to the level of high water, and also of the east pier made solid to not higher than *half flood* level and open above, the extension of the two piers being parallel, but each side set back 10 feet from the present line, so as to add 20 feet to the present width of the entrance, which, just at entering, would be an improvement.

Secondly, the erection of a groyne or jetty from the foot of Barrow Cliffs, across the Fricker rocks, which are 1,100 feet west of the entrance; or,

Thirdly, a groyne at about 100 feet west of the harbour, extending 300 feet from the end of the pier, and 200 feet within it, the whole length being, therefore, 500 feet, its top level with the high water of spring tides.

The advantages of the first plan would be the still further confining the current out of the harbour, acting in continuation of the system which has hitherto been pursued, and operated so materially in the removal of the bar; by deepening the entrance, and facilitating the ingress and egress of shipping, while, at the same time, it would be effectual in the removal of the greater evil, viz., the seas upon the east pier, and, by extending the piers, the shingle would be more likely to be passed round the east pier. The objection is the expense, which would be considerable.

The second plan, viz., a groyne or jetty at the Fricker Rocks, would be effectual in the removal of the present evil, and would shelter a considerable space between it and the harbour from the worst westerly winds, which space might be useful as a refuge for small vessels and pilots' boats. It would also enable the ebb out of the harbour to act with greater effect, from not being interfered with by a cross current, and would be more certain than any of the other plans to pass the shingle to the eastward of the harbour's mouth. The objections that might be offered to it, are, that it would stop for a time the shingle passing to the eastward for the supply of the bank, and that with easterly winds and the tide from the eastward, vessels bound westward would have difficulty in clearing the groyne or breakwater. I think that both these objections can be effectually replied to; a third objection is more real, viz., the heavy expense, owing to the length, which to be useful, should be about 1,100 feet, and to the depth, which at the outer end will then be eight feet at low water.

The third plan, viz. the groyne at 100 feet west of the harbour, is proposed by Mr. Stevens, which, when his long experience as a seaman, and his intimate knowledge of the harbour are considered, is a strong argument in its favour. Independently of this, I think favourably of its efficiency for removing the immediate evil; it has also the advantage of being by far the cheapest, Mr. Stevens' estimate being only about £1,000, and if the funds should at any future period allow the piers to be carried out according to the plan first described, the groyne would still be very useful, in breaking the seas before they would reach the piers, which is a great argument in its favour. Its inferiority to the other, is its doing but little in assisting the ebbing tide, and that after a "*full*" to the west of it, the shingle will get round its end, fill the space between it and the west pier, and thus tend to divert the current and entrance of the harbour from a straight line, to an easterly or curved direction, which was the case when the piers were of unequal length. To an extent also the difficulty of ships getting clear of it during strong easterly winds will be felt.

On a full consideration however of all the circumstances, and bearing in mind what was said to me respecting the revenue of the Commission, I am disposed to recommend the third plan, viz., the erection of a groyne near to and on the west side of the west pier, proposed by Mr. Stevens, as being on the whole the best thing to be done for a first measure. Should the shingle *between* the piers continue to be troublesome, I think it may be removed without much expense. Not so what may accumulate between the end of the west pier and the proposed groyne, but I shall be glad in this to find Mr. Stevens' opinion, that the groyne will pass the shingle clear of the harbour, to be correct. An increase of trade and of funds will I trust enable the Commissioners to undertake more extensive works, and then will be the time for considering as to the extension of both piers. In the mean time let me impress upon them the necessity of preventing any diminution, by enclosures or otherwise, of the backwater, which is the lungs of the harbour.

I am, Sir,

Your most obedient Servant,

J. WALKER.

Edward Verral, Esq.,

Clerk to the Commissioners and Trustees of Newhaven Harbour and Piers.

ON THE PRESERVATION OF TIMBER.

REPORT TO THE TREASURER OF THE BRIGHTON SUSPENSION CHAIN PIER COMPANY, UPON THE PRESERVATION OF TIMBER FROM DECAY, AND FROM THE ACTION OF SEA WORMS. BY WILLIAM B. PRICHARD, ESQ., C. E.

SIR,

AGREEABLY to your request, I have to report to your Directors on the existing mode of preserving the timber and piles at the chain pier, and the method that ought in future to be used in preventing the decay and destruction of the timber, &c.

A certain method of preserving timber from decay, from the ravages of the *Teredo navalis* and other sea worms, is of the utmost importance to the stability of such works as the chain pier, owing to its very foundation being composed of timber piles.

I will first notice the existing modes and means made use of. Stockholm tar has been used, and proved to be of little service; this tar is objectionable, owing to its high price, and also from its being manufactured from vegetable substances. All tars containing vegetable productions must be detrimental to the preservation of timber, especially when used in, and exposed to, salt-water: this tar does not penetrate into the wood, and in a very few weeks the salt acid of the sea will eat it all away.

Common gas or coal tar has been used to a great extent, and its effects are apparent to all. It does a very great deal of harm, forms a hard and brittle crust or coat on the wood, and completely excludes the damp and unnatural heat from the possibility of escape, owing to its containing ammonia, which burns the timber, and in a few years turns brown and crumbles into dust. Indeed, timber prepared with this tar will be completely destroyed on this coast and pier by the ravages of the *Teredo navalis* and the *Limmonia terel runs*, in five or six years.

Also Kyan's patent, *corrosive sublimate*, or the *bichloride of mercury* has been used; but has proved equally useless. I inclose you a printed letter on this subject, and I have only to add, that the sleepers kyanised five years ago, and in use at the West India Dock Warehouses, have been discovered to decay rapidly; and the wooden tanks at the Anti-Dry-Rot Company's principal yard are decayed.

Secondly. I would recommend you for the future to use "*Oil of Tar* and *Pyrolignite of Iron*." This process will, without a doubt, succeed; I have proved in hydraulic works on this coast, that it will fully prevent the decay in timber piles, destroy sea worms, and supersede the necessity of coating the piles with iron nails. In Shoreham harbour, for instance, there is a piece of red pine accidentally infused with pyrolignite of iron, which after being in use twelve years, is perfectly sound. There is another waling piece, the very heart of English oak, kyanised, and in use only four years, which is like a honey-comb or net-work, completely eaten away by the *Teredo navalis* and other sea worms. I have fully proved the efficiency of this method at different harbours and docks. Sixteen years ago I had timber prepared with it, and in use on the shores of the Dee, and it is at the present moment perfectly sound. Mr. Renwick, C.E., of New York, has used oil of tar with perfect success for many years.

The pyrolignite of iron must be used of very pure quality—and the timber must be dry—afterwards the oil of tar must be applied, and not on any account must it contain a particle of ammonia.

I am given to understand that John Bethell, Esq., of Vauxhall tar works, London, has taken a patent for preparing the oil of tar; therefore you can procure it from his works without going to the trouble of having it prepared.

The immense destruction, by the sea worms on this coast, of timber, and the important fact, that at the chain pier there are not twenty of the original piles remaining at the present time, is of itself sufficient to awaken anxiety in your minds respecting the best mode of saving your valuable property. The subject will have my best consideration. I am, Sir,

Your obedient servant,

WILLIAM B. PRICHARD.

Shoreham, July 26, 1842.

[N.B. There is a slight mistake in the above Report: Mr. Bethell's patent is for "preparing wood by impregnating it with either the oil of mineral tar, or with pyrolignite of iron, or both." The oil of tar can be purchased at his tar works, and parties purchasing it are licensed to prepare the wood themselves. Mr. Renwick, of New York, has followed Mr. Bethell in the use of the oil of tar, Mr. R.'s patent in America being dated many months after Mr. Bethell's patent in England.—ED.]

[The following is the letter referred to above: it was inserted in the Brighton Guardian of May, 1842.]

THE phenomenon of dry rot in timber has often been lamented, though almost invariably misunderstood. Certain harmless plants, such as *Merulius destructor* and *Merulius lachrymans* (so called from the quantity of fluid which replenishes the hymeneum), the latter a misnomer when connected with *dry* rot, are held up to public execration as the delinquents chargeable with the work of destruction. They stand, however, fully acquitted in the eye of science, as the deed is done before they make their appearance even in embryo, although their rudiments are already there in seeds. Like the worm of corruption, they riot in decay. It is the matrix wherein they germinate; but this disintegration of the organized structure has been already consummated. It is assumed by Mr. Kyan, that the cause of dry rot is to be sought for in the decomposition of the albumen of the sap; and thus forming a substance indecomposable by the usual agencies of decay, it constitutes the principle of his patent. Doubtless albumen may be arrested in its tendency to decay by chloride of mercury, or by corrosive sublimate; but it is sheer assumption and rank folly to say that dry rot has to do with the albumen of the sap. To say so may sound very well in useless theories, but it will not avail in practice.

Sir William Burnet, in his counter patent, employs, I have been given to understand, a salt of zinc.

The great price of mercury is an obstacle to Kyan's plan, provided it were useful to the public; and it seems that great success does not follow the process. I heard that Sir H. Davy had selected chloride of mercury for a similar purpose, but afterwards abandoned it. I opposed it on the same ground, that in tropical climes it would be as poisonous as the quicksilver mines of Illyria. Independently of its ready decomposition by the contact of iron or an alkali, there is, unhappily for the cause of truth and the advance of genuine knowledge, much favouritism in a name, and party spirit runs as high in the coteries of science as in the upper regions of politics. Sir John Barrow, in his Life of Lord Anson, has entirely impugned Kyan's process. The Duke of Portland has done the same thing in 1838, and to the same effect are the conclusions of Lord Manners, and a host of other scientific men.

Dr. Moore in his experiments at Plymouth has shown that kyanized wood is not proof against the ravages of the *Teredo navalis*, or sea worm; it was honeycombed like the rest; and of this fact I have a proof before my eyes daily.

The experiments made at Welbeck in the mushroom house are very instructive and important, and appear entirely conclusive. Good Baltic timber in these trials lasted longer than the best kyanized oak. In other places it has been tried, and invariably found, kyanized or not, to decay, especially when exposed to the sea or salt water. On the other hand, pyrolignite of iron will resist decay longer than any timber prepared by patentees. I may here add, that I wrote on this subject ten years ago, and recommended pyrolignite of iron. I have also experimentally proved that pyrolignite of iron, or chloride of copper, will coagulate albumen; and therefore this property does not exclusively pertain to corrosive sublimate.

I am satisfied to leave the profession to judge whether pyrolignite of iron, &c. has not in point of practice superseded all the patents. Look at the Chain Pier at Brighton, and you will see an attempt to use a substitute for it, by covering the piles with iron nails, which is an expensive process compared with the real remedy.

REPORT TO THE COMMISSIONERS OF THE PORT OF ARUNDEL UPON THE HARBOUR OF LITTLEHAMPTON.

BY JAMES M. RENDEL, ESQ., C.E.

[We hope to have, shortly, the opportunity of presenting our readers with a history of the harbour of Littlehampton, illustrated by copies of the Reports that have been delivered at different times by various engineers. Preparatory to these, we publish the following report by Mr. Rendel, which was the last upon the subject, and though written four years since, has been seen by few if any of our readers.—Ed.]

Gentlemen,

Agreeably to an arrangement made with Mr. William Holmes (your clerk), I met him at Arundel on the 20th ultimo, and on the three following days was engaged inspecting the harbour's mouth at Littlehampton, and the river from thence to Houghton Bridge.

Previously to my leaving Arundel, I had the honour of attending you at a meeting specially convened, when I received your instructions to report on the following queries:—

First. "Whether the proposed new navigable cut at South Stoke would endanger the welfare of the port, by withdrawing from it the supply of water necessary to scour its bar at the harbour's mouth, during the summer months, when the principal trade is carried on: at the same time, also, whether the new cut would in any way endanger the welfare of the harbour, either with reference to its connexion with the canal at Hardham, by letting off too rapidly the waters necessary to carry barges into that canal during the summer months and dry seasons at neap tides, or be in any other way injurious?"

This harbour, like all others of its class, is maintained by the power of the back-water, which, being sufficient to drive to sea the gravel and sand washed up at its mouth, keeps open a navigable channel. Such harbours are commonly called "bar harbours," being always attended with a bank, or bar, at the point where the current of back water is lost in the sea, or destroyed by the tidal current of the coast.

It will be evident, from this description of a bar harbour, that its depth and general capacity are determined by the power of its back water, compared with the tendency of the sea to form shingle or sand banks at its mouth; and that harbours situated on a coast so encumbered with sand and shingle as the coasts of Hampshire, Sussex, and Kent are, demand from their conservators the strictest vigilance to maintain their ancient receptacles for tidal water.

It will be inferred from these remarks, that I shall recommend you to oppose any attempt at an encroachment on the capacity of your harbour to contain tidal water. If, therefore, the new navigable cut proposed to be made at South Stoke has such a tendency, I should certainly recommend a resistance to it. This point I shall now therefore consider.

It appears by the plans which the Sewer Commissioners have published, that the new cut is intended to be formed 60 feet wide at the surface, and 13 feet deep, with slopes of one to one for the first half of the depth, and below, of one-and-a-half to one, making its width at bottom 29 feet. On comparing these dimensions with the plans and sections of the river, made by Mr. Macneill in 1836, by order of the Commissioners of Sewers, it appears beyond all question, that if a new channel is thus made, it will draw off from the old channel the whole of the fresh and tidal water; in other words, that the new channel would be the main course of the river. For a time this would not be attended with loss of back water; on the contrary, the quantity would be increased by the amount which the new channel would contain. But the effect of depriving the old channel of all current, would be its rapid silting up, and consequently there would be a loss of water by the serious difference between the area of the old, compared with the new channel. It is true that the new channel will let more tidal water into the river above South Stoke, but, judging from the observations of the river tides (apparently made with such accuracy), by Mr. Macneill, and given in his sections, it is not to be expected that the extra flow will be more than a few inches: it will therefore fall very short of the loss which the filling up of the old or "Horse Shoe" channel would occasion.

It has been said that the loss of tidal water from a part of the river so remote from the harbour's mouth as South Stoke, viz., upwards of ten miles, cannot damage the harbour, since it does not ebb off before the return of the tide; in short, that it is so much dead water in the river. The fallacy of this argument is obvious, more especially when it is considered that the tidal scour is as much wanted to preserve the navigation of the river, as it is to scour the harbour's mouth.

I am therefore of opinion that the new cut, as proposed to be executed, would be attended with the ultimate loss of a considerable quantity of tidal back water, and that it is highly objectionable on that account. I am also of opinion that, unless the slopes of its sides were made much flatter than shown on the sections, and also secured with rock, chalk, or some such means of guarding the natural soil from the influence of the current, large slips would take place, the soil from which would form shallows and banks in the channel of the river.

With reference to the effect that such a cut would have on the navigation of the river, by letting off too rapidly the water necessary to take barges to the canal entrance at Hardham, &c., I am of opinion that if the Sewer Commissioners make this cut, it will be found necessary to remove the whole of the shallows between it and the entrance to the several canals, as the effect would undoubtedly be not only the quicker discharge of the water from the upper part of the river, but its discharge to a lower level, so as to increase the number of hours each tide that the shoals offer an impediment to the navigation. It will for the same reasons increase the value of, I had almost said the necessity for, a towing path.

These are objections which apply to the plans that the Commissioners of Sewers have lately had under their consideration. I am, however, of opinion, that they may be modified so as to combine all inteiests. It is therefore with satisfaction I am able to report that Mr. Macneill, who is now engaged by the Sewer Commissioners to revise their plans, is ready to confer with me, and to adopt such alterations as shall insure the necessary current through the old or Horse Shoe channel, to keep it open, as well as the maintenance of the present extent of navigable accommodation up to the several canals. Such plans will be prepared by Mr. Macneill, in the course of next month, and when submitted to me, I shall be ready to report on them for your guidance.

Second. "Whether the river being widened round the Horse Shoe Reach would not answer all the purposes for draining the lands above the new cut proposed to be drained."

It appears by calculations I have made from Mr. Macneill's sections of the river, that the mean area of its channel round the Horse Shoe Reach is one third less than the mean area for an equal length any where below, and that its fall is less in the same proportion. Such a diminution in size and fall must act as an impediment to the discharge of land floods.

A sufficient widening of the river would of course be a remedy for this evil, and would I have no doubt relieve the lands liable to be flooded.

I deem it proper to remark, before proceeding to consider your third question, that I have never, in the course of my professional experience, witnessed such neglect of precautions for the drainage of low-lands, as in the present case. Instead of carrying off the upland water at a high level, it is allowed to fill the lower dikes.

These dikes are also neglected, and worse still, the sluices which discharge the flood waters from them into the river, are of the worst possible kind. I name these defects from a conviction that the owners of the lands now liable to be flooded, have, within their own hands, a remedy much more efficient than any which the Sewer Commissioners can afford them by straightening the river.

Third. "Whether the works lately erected by Mr. Richard Isemonger, or Mr. Stephen Olliver, near the Ferry at Littlehampton, are prejudicial to the well doing of the harbour in any way whatever?"

This is one of the land-making encroachments which are too commonly found on the shores of almost all harbours where, from the establishment of trade, land has been made valuable. The practice is highly reprehensible, for the evils which arise out of it are of the most ruinous kind to the harbour. The prevention of such encroachments is, I am aware, one of the most onerous duties which the local conservators of a harbour have to perform: it is, however, one of the most imperative, and such as they ought rigidly to fulfil

I would recommend in this case, as I have advised in all other similar ones, that an accurate plan of the shores of the harbour should be made, upon which a competent engineer should lay down the proper lines for all wharfs, or other water-side premises, and that such plan should be kept in the office of the harbour master for easy reference. An observance of this plan relieves the conservators from any charge of partiality, and insures a uniformity of design which at once protects the harbour, and the true interests of the owners of the adjoining lands.

One of the most obvious defects in the harbour at Littlehampton, is its limited extent. For instance, its length from the inner end of the entrance piers to the ferry, is not more than 2700 feet. The first 2000 is from 400 to 450 feet wide at high water, and the remaining 700 feet, or higher portion, is suddenly contracted by a projection on the western side to widths varying from 250 to 300 feet at high water.

Now it is on the shore of this already contracted part of the harbour, and still worse, on the west side, where the objectionable contraction occurs, that Mr. Stephen Olliver and Mr. Richard Isemonger have erected the works referred to.

It appears by the measurements furnished by Mr. Teasdale, that the piers built by Mr. Olliver project upwards of 70 feet into the high-water channel of the river, and that Mr. Isemonger's wall projects not less than 60 feet, and that these projections embrace a frontage of upwards of 300 feet. The result of these works is therefore still further to contract nearly one half of the upper or narrow part of the harbour from 290 feet to about 220, by a kind of large groyn: in short, to create precisely that kind of obstruction in the harbour, which you have been for the last ten or twelve years removing in less important parts of the navigation at an enormous expense.

These are objections which apply to the works in question, as obstructing the tidal current, but the erections are no less objectionable to the accommodation of vessels taking up their berths in the harbour. For instance, supposing a vessel of say only 25 feet from out to out of her chain plates to be at the opposite wharfs in this contracted part of the harbour, the clear width would then be reduced to 170 feet. In such a contracted space it would not be possible for a vessel of ordinary size to turn or swing when the tide was running strong, without danger of fouling, and as it is a common practice in the port for vessels to run in with the tide, and drop anchor in this part of the river, so as to swing or warp to their berths, much mischief would undoubtedly arise from the great contraction of the harbour by these erections on its shore.

I am therefore of opinion that the works lately erected by Mr. Richard Isemonger, and Mr. Stephen Olliver, are objectionable, not only as occasioning an additional obstruction to the flow and ebb of the tide, but also from their contracting the width and impairing the convenience of the harbour.

Fourth. "Whether any improvement can be made with reference to the mooring places, and the berths of the vessels in the harbour and the ferry boat therein; also as to the manner of mooring vessels both at Littlehampton and Arundel?"

The system of mooring vessels to a frame-work of piles driven firmly into the bed of the harbour at proper intervals along the margin of low water, as practised by you, is an excellent one, giving as it does the best possible fastening, whilst avoiding the necessity for anchors and warps into the channel of the harbour, which, in such a contracted one as yours, would be dangerous to boats, and occasion great obstruction to the passage of vessels.

To determine the proper position and number of such moorings is within the province of your harbour-master, but it occurred to me, that the four moorings in the narrow part of the harbour, immediately below Mr. Stephen Olliver's premises, are ill placed, and must frequently interfere with shipping in bringing up here, which it seems is a common practice. A better place for these moorings would be in the wider part of the harbour, opposite, or a little below the town quay.

It also appeared to me that two or three more of these mooring stages in the river, between Littlehampton and Arundel, and especially one or two near Arundel, would add much to the accommodation of shipping.

The ferry boat is undoubtedly a considerable impediment to the navigation and current, being moored at right angles to the course of the river, and filling one third of the low-water width of the channel. The width of the channel at high water at the site of the ferry, is reported by Mr. Teasdale to be 340 feet, at low water 151 feet, with a depth of 7 feet. The ferry boat is 70 feet long, and draws 2 feet water. It is therefore manifest, as before stated, that a vessel of such dimensions moored across so contracted a part of the river, will create an impediment to passing vessels, as well as to the tidal current.

This ferry is undoubtedly a great public convenience, and had its landing place on either side been recessed, so that the boat, when not crossing, might be in a kind of dock, that is, lie clear of the stream, all interests would have been consulted.

This improvement might still be carried into effect by excavating a basin, or dock, of the length of the boat, that is, 70 feet, with three feet depth of water at low water to float her. The cost would not exceed £300, whilst the efficiency of the ferry would not be impaired.

Fifth. "Also as to the removal of the bar at the Harbour's mouth, the accumulating shingle between the works there, as well with reference to the obtaining of ballast for vessels as otherwise?"

And,

Sixth. "Whether Mr. Rendel can suggest anything further for the improvement of the port, or likely to be beneficial thereto?"

These two last questions are so intimately connected, that they can be best answered together.

To answer them as fully as I could wish, and as their importance demands, I should require more extensive and accurate surveys than now exist of the harbour and its coast, with a series of observations on the tides, both along the shore, and the roadstead or offing.

In my answer to your third question, I have recommended that a plan of the harbour, showing a shore line to which all erections are to be restricted, should be an office document for your harbour master. In addition I would propose, as of great importance, that such map should contain numerous lines of soundings, surrounding the entrance to the harbour, as well as across its interior, and that the harbour master should be required every year to sound and register the depths, and compare them with those of the preceding years. This would be an easy operation, and such as any ordinary harbour master could perform, provided the sounding lines are between points well defined, and the depths dated from some permanent mark, the level of which, compared with the tide gauge, was well known. Such a map or chart as this would show, with minute accuracy, the changes taking place, both within and without the harbour, from year to year; and from it might be gained information which would ensure the adoption of right plans for its preservation and improvement. It is one of the greatest misfortunes in all harbour engineering, that from the want of such plans, engineers have to trust to isolated observations, and to draw uncertain conclusions from conflicting evidence.

The most obvious improvement, and one quite within your means, is the completion of your recent labours in the removal of groins in the river, between Littlehampton and Arundel. These groins not only check the current of the river, and lessen its scouring influence, but impede the flow of the tide, so as to lessen the depth for the accommodation of shipping, also the quantity of water to ebb out, and consequently the means of keeping the bar in subjection.

It is reported that since your attention has been directed to the removal of these groins, the tide rises six inches higher at Arundel Bridge.

Another obvious advantage would be derived from the erection of a ballast quay at Littlehampton. At present it is a practice for vessels to take in their ballast from any part of the harbour, at the option of the master; the consequence of which is, that the supervision of the harbour master is made very difficult, and the harbour channel very subject to nuisance.

It seems that your last Harbour Act gives you power to compel vessels, if required, to take their ballast from an appropriated quay, and it would be well for you to avail yourselves of its powers.

It is to be regretted that you have not the power to become ballast masters, so as to derive an income from a source which almost all other harbours possess. You would then be able to keep a proper dredge vessel constantly at work on the shoals of the harbour in rough weather, and at the bar in fine, and to dispose of its labour as ballast, or in a way that would be profitable. This is a matter deserving your serious consideration.

I remarked with much concern, that an embankment is in progress of formation by you across the mud lands immediately within the western pier at Littlehampton. I would strongly recommend, not only the abandonment of this work, but a removal of the soil already deposited in its formation. I am aware that your object in carrying out this work is to complete the towing-path which you have, with so much benefit, made up to Arundel, quite down to the entrance piers. But up to this point you have not made encroachments on the mud lands or back-water receptacles, and consequently have so far accomplished a great convenience, without committing yourselves by creating an injurious precedent. In the case now adverted to, no convenience is to be derived from a towing-path, which should induce you to set a bad example.

In conclusion, I feel I cannot do you a greater service than to press upon your consideration the protection which the harbour would derive from your causing such a plan as I have recommended to be made without delay. In the execution of this very desirable measure, I should be most happy to lend you my aid in providing you a proper marine surveyor, and in giving him the necessary instructions.

In looking at the changes taking place from the extensive employment of steam ships, the favourable position of your harbour, as connected with the metropolis, cannot be overlooked; and I am decidedly of opinion that the time is not remote, when, from the advantages it possesses, as the embouchure of a great river on the most sheltered part of the coast, the attention of the public authorities will be turned to it as being the most convenient and eligible site for a great steam boat harbour.

Should I have overlooked anything, or have been less explicit upon any point than you have had reason to expect, I shall be most happy to supply such omissions. I have the honour to be,

Gentlemen,

Your most obedient Servant,

JAMES M. RENDEL.

34. *Great George Street*, *March* 28, 1839.

AN EXAMINATION OF THE PRINCIPLES ON WHICH THE 'AERIAL MACHINE' HAS BEEN CONSTRUCTED.

[We have been favoured with the following paper by G. W. Hearn, Esq., M.A., who highly distinguished himself at Cambridge, in 1839, where he took his degree as sixth wrangler, and has since been well known in London as a mathematical tutor.

The author has demonstrated an important dynamical problem suggested by that modern novelty, the aerial machine, which will be so far satisfactory to the inventor, but we hope the investigation will be continued, and that the utter impossibility of success, which is capable of mathematical proof, will be demonstrated.—Ed.]

The description of this machine has already appeared before the public.

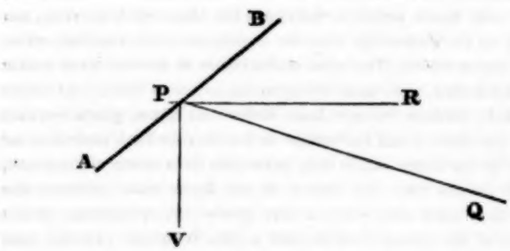
The dynamical problem which I intend to discuss in this paper may be formally enunciated as follows:—

"Whether it be possible by means of a constant force to cause a flat lamina to move through still air with uniform horizontal velocity?"

I think, however, that the popular reader will be much assisted in comprehending the solution of this dynamical problem by first considering the corresponding statical one, which we may state as follows:—

"By what forces besides resistance can a flat lamina be maintained in equilibrium in air moving against it with uniform velocity?"

To the solution of this, which is nothing more than investigating the equilibrium of a kite, we will first direct our attention.



Let RP be the horizontal direction of the wind's motion, AB a section of the lamina, the plane of which is perpendicular to that of the paper; the angle $RPB = \alpha$. Let PQ be the direction of the applied force, and angle $QPB = \beta$. Let F be the tension of PQ; v the velocity of the wind, and therefore $v \sin \alpha$ the resolved part perpendicular to AB; and if R represent the resistance according to the usual law, we shall have $R = k^2 (v \sin \alpha)^2$ in direction perpendicular to AB.

The horizontal and vertical resolvents of R are $R \sin \alpha$ in direction RP, and $R \cos \alpha$ in direction VP.

The horizontal and vertical resolvents of F are $F \cos (\beta - \alpha)$ and $F \sin (\beta - \alpha)$ in directions PR and PV respectively; and the weight of the lamina, which let $= w$, acts in the direction PV. Now, in order that the lamina may be in equilibrium, we must have forces in PR = forces in RP, or

$$F \cos (\beta - \alpha) = R \sin \alpha \quad (1)$$

and also forces in PV = forces in VP,

$$\text{or, } w + F \sin (\beta - \alpha) = R \cos \alpha \quad (2)$$

From these equations we find

$$F \cos \beta = w \sin \alpha$$

$$\therefore F = w \frac{\sin \alpha}{\cos \beta} \text{ the tension,}$$

and

$$R = w \cdot \frac{\sin \alpha}{\cos \beta} \frac{\cos (\beta - \alpha}{\sin \alpha}$$

$$= \frac{w \cdot \cos (\beta - \alpha)}{\cos \beta}$$

It is to be observed that these equations are independent of any law of resistance. Hence, by means of kite-flying we may easily determine the law of this resistance. Thus α is an angle which may be observed, β may be calculated from knowing the height and distance of the kite and the form of the curve which the string assumes, which in the case of its being uniform is the catenary. The above equations will then give us the value of R; then, assuming

$$R = Av + Bv^2 + Cv^3 + \&c.,$$

and making several experiments, and having consequently as many sets of values of R and v, we obtain equations by which the coefficients A, B, C, &c., may be calculated.

We now proceed to the dynamical problem.

This we may proceed with nearly in the same manner.

We have resultant of moving forces in $PR = F \cos (\beta - \alpha) - R \sin \alpha$, and w being the weight, we have therefore accelerating horizontal force

$$= \frac{F \cos (\beta - \alpha) - R \sin \alpha}{w} g$$

Also resultant of moving forces in PV is $w + F \sin (\beta - \alpha) - R \cos \alpha$, and therefore

$$\frac{w + F \sin (\beta - \alpha) - R \cos \alpha}{w} g$$

is the accelerating force downwards.

But if the machine is moving with uniform velocity, these accelerating forces are each $= 0$, and thence we have the same values of F and R as before.

That is

$$F = w \cdot \frac{\sin \alpha}{\cos \beta} \quad R = \frac{w \cos (\beta - \alpha)}{\cos \beta}$$

Hence, taking the usual law of resistance, we have

$$R = k^2 \sin^2 \alpha \cdot v^2,$$

$$\therefore k^2 \sin^2 \alpha \cdot v^2 = \frac{w \cos (\beta - \alpha)}{\cos \beta}$$

$$\therefore v = \frac{\sqrt{w \cos (\beta - \alpha)}}{k \sin \alpha \cdot \sqrt{\cos \beta}}$$

will be the horizontal motion of the machine.

To find the most advantageous direction for the force which acts on the machine.

$$\text{Since } F = w \cdot \frac{\sin \alpha}{\cos \beta}$$

the more β is diminished the more will F be diminished, so that if $\beta = 0$, or the direction PQ of the force coincide with HB, then $F = w \sin \alpha$, which by diminishing α may be made as small as we please.

This value of β gives

$$v = \frac{\sqrt{w \cos \alpha}}{k \sin \alpha}$$

which is greater the more α is diminished.

If the direction of F be horizontal $\beta = \alpha$,

$$\therefore F = w \tan \alpha$$

$$v = \frac{\sqrt{w}}{k \sin \alpha \sqrt{\cos \alpha}}$$

It is somewhat singular that the ratio $\frac{v}{F}$ is the same in those two cases, but as the diminution of F is the most desirable point to be attained, the first direction will in all probability be used, that is, force exerted by fantails parallel to the plane of the frame.

From this calculation, provided the initial horizontal motion can be communicated, we see that the force necessary to preserve it, and thereby at the same time keep the machine from falling to the ground, will be very small.

To illustrate further this matter, I have calculated the values of F and v for the following given values of α, w, and k.

$$w = 6000 \text{ lb.} \quad \alpha = 5°,$$

and by the best experiments

$$k = \cdot 0478 \text{ S.}$$

from the formula $F = w \sin \alpha$ we have $F = 523$ lb. nearly, and if there be 10,000 square feet of resisting surface, the velocity is 320 feet per second, or about 218 miles an hour.

AN ACCOUNT OF THE RECLAIMING AND DRAINING OF LAND IN THE BEDFORD LEVEL, COMMONLY CALLED THE GREAT LEVEL OF THE FENS.

BY HARDY WELLS, C. E. AND SURVEYOR.

(*Continued from page* 114.)

Some apology may be required for my extended remarks on the early history of the Fens, but this important district differs so materially from every other part of the kingdom, that it seemed necessary fully to explain its former condition, before I introduced the reports of the engineers who have been at different times employed in the various schemes of drainage. I have, however, carefully avoided a detail, which would have been tedious, of the litigious proceedings that attended so many of the attempts to secure the Fens from the dominion of the waters.

The separation of the Fens into three levels, already mentioned, naturally produced a separation of interests, and the improvement of one portion was then no longer considered a common good. Each division was represented by persons who received separate advice, as emergency required. It is now too late to regret this division of interest, or to show the advantages of union, for it is quite certain that they cannot be re-united, as long as one division is enjoying the advantages of a "natural" system of drainage, and the other suffering all the evils which result from its unimproved condition.

There is little left for me to state respecting the North Level, until I arrive at the period when the late Mr. Rennie made his first Report.

The building of Denver sluice was always a matter of regret to those persons interested in the navigation, although their interests must have been promoted by any measure that improved the drainage of the lands. In the year 1713, Denver Sluice was destroyed by the tides. During the first two years after the fall of this sluice, the spring tides, finding their way into some of their ancient and natural receptacles, by the return of their ebbs, the channel between the sluice and Lynn was so much deepened, that the waters between Salter's Lode and Lynn, which had fifty years before lost their way to sea, began to return to their old course. This happened although the seasons were dry, and consequently a less quantity of fresh water came into the rivers above Denver Sluice and the Hundred Foot, to join the ebbs in eroding the channel. If the summers had been wet, the depth would of course have been greater, in proportion to the quantity of water which passed to its outfall at sea.

But this improvement did not continue long, for the spring tides which flowed up the Hundred Foot, always ebbed at least an hour before the ebb in the river Ouse, above the sluice, and in consequence of the greater ascent of that river, and the stronger resistance of the freshes, the water continued to descend whilst the tide was still drawing into the river Ouse, above the sluice, and as it was not strong enough to oppose the great body of water that continued to flow up the river, it returned into the channel of the river above the sluice, and, carrying an additional quantity of silt, raised the bed higher and higher, so that the height of the spring tides continued to diminish, and the power of the ebbs decreased in proportion. When the wet seasons returned, the land floods brought down by the Hundred Foot swelled that part of the river sooner than the lesser body out of the rivers which lay above the sluice. And as the sluices were standing, these floods, whenever they descended, kept the flood gates of the sluices shut for weeks. This was the cause of the fall of the sluice. These floods took their course through the remains of the sluice up the Cambridge river, instead of running to their natural outfall, by Lynn to sea. Elstobb says it was observed in November and December 1720, that the land floods which so descended the Hundred Foot river, ran violently up the Cambridge river for twenty-one days together, without any intermission. The mischievous effects of this awkward course or counter-stream, were soon felt upon the outlets of Marshland before mentioned, between Salter's Lode Sluice and Lynn, which were all choked up again; and the bottom of the river on the Cambridge, or Ely side of the sluice, which was, before the destruction of the sluice, ten feet deeper than the bottom on the Lynn side, (because the tidal waters were shut out) as was proved by plumbing, in the presence of Sir Henry Hobart, and a Mr. Walpole. In the year 1695, the river was silted up ten feet in the compass of five or six years, three or four feet of which was raised with the silt carried in, in the twenty-one years I have before mentioned. The effects of this counter stream, or contrary current, is better explained in the following affidavit, taken January 22nd, 1723, by the Mayor of Lynn:

"John Fuller, beaconer and master pilot of the port of King's Lynn, Captain John Edwards, and Captain Samuel Longs, masters and commanders of ships of the said port, and Thomas Badeslade, gentleman, surveyor, and professor of mathematics, do severally make oath that they, at the request and by the direction of the mayor and chief magistrate of the borough and port of Lynn aforesaid, did on Monday the 20th of January instant take a view and survey of that part of the river of the Great Ouse, that is, adjacent to the place where Denver Sluice late stood, and were there three hours before flood from sea, where they were met by William Stafford, Esq., and the reverend Mr. Peter Bateson, clerk, and all of them did observe, and do certify and report, that the fresh-water floods descending the Hundred Foot drain, otherwise called Bedford River, instead of having its due course towards the sea, did run violently through the remains of Denver sluice, towards Ely and Cambridge, at the time of our first coming thither, and continued so to do till the flood tide from the sea came up to that place, and then both the tide and land flood from sea united and run together up towards Cambridge, but the tide did not put into the Hundred Foot river at all.

"And do further certify and report, that they were informed by the ferryman, who constantly attended the ferry there, and others inhabiting those parts, that the tides and land floods had continued to run in that course and manner up towards Cambridge, so at least a week together before our said view, without any manner of return to seaward, and that the said great river Ouse at the ferry place is silted up seven feet at least since the said floods and tides have had this course. That these deponents did all of them ride about one mile up the said Bedford river bank, to a cross bank in the washes, and did there observe the said washes, which are about half a mile over, and twenty miles in length, covered with a great depth of water, and have good reason to believe the flood will continue running up towards Cambridge and Ely for some time longer. And do believe and assert that, unless some speedy means be taken to prevent the land floods from taking this awkward course, contrary to their natural outfall to sea, the river of Cambridge will, by them and the tides, be entirely silted up, and in a short time both navigation and drainage be wholly lost.

"And the said William Stafford, Peter Bateson, and Thomas Badeslade, severally make oath, that several times this last summer they have observed that the spring tides which put up into Cambridge river did not ebb back, but kept running up through Ely bridge for several days, occasioned partly by the indraught near above Ely, and the waters of the Bedford river over-riding the Cambridge river, and in its ebb, all spring tides flowing up the said Cambridge river at least one hour, and sometimes two hours after the ebb of Bedford river, which gave so much time for the silt from the sea to settle, that must in a short time, by that means, be quite choked and lost.

"And do observe that the same river is already silted up, that the neap tides cannot reach or put up into the rivers of Stoke, Brandon, Mildenhall, or Cambridge, as they were wont to do; and that the harbour of Lynn being thereby deprived of its great and ancient receptacles and returns of backwaters, does in consequence daily decay and grow worse, to the eminent danger of that port and navigation."

As the upland waters which passed through the Middle Level by the river Nene from Peterborough through Standground Sluice had their outfall at Salter's Lode into the Ouse, it must be evident that by the choking and silting up of that river the Middle Level was injured

and prejudiced in the same manner as the South Level. The condition of the South Level, after the destruction of the Denver Sluice, gradually became worse; and, in the year 1723, a petition was presented to the Board of the Bedford Level Corporation by the land owners and inhabitants of Ely, as well as by persons from Soham, and many other places within the South Level, in which they complain of loss and detriment since the destruction of Denver Sluice, and propose, as a means of relief, the stopping of the flux of the sea where the sluice stood, and such works as would make navigable two small sluices on the side of the sluice, opening and scouring out St. John's Eau, allowing the outfall to be where that Eau was first intended to be placed. The Board of the Bedford Level Corporation were, however, unanimously of opinion, *that the method of relief proposed by the petitioners would not answer their expectation by removing the grievances of which they complained, for the main cause proceeded from the large accumulations of sand which then lay between Germain's Bridge and Lynn.* But the Board, at the same time, hoped to obtain effectual relief for the South Level by the adoption of plans then under their consideration. One of these was, the formation of a nearer channel for the waters of the Ouse from St. Germain's to Lynn; but this measure, being then generally unpopular, was not executed. Instead of improving the OUTFALL or river Ouse below Denver Sluice, the Bedford Level Corporation united with other landed proprietors to cleanse and deepen the channels of the Nene where it fell into the Ouse at Salter's Lode, hoping that the outfall might be made efficient by the greater scouring force of the water. This, as may be supposed, failed to accomplish the object, for it could not be of any use to lower the beds of the internal river, if the outfall, or rather I should say the immediate channel to that outfall, still retained its original height. The effect of this work was to retain the water by increasing the sectional area of the river, instead of forcing it to the outfall in deep water.

Although the proprietors of land in the South Level, as well as the persons interested in the navigation, had loudly complained of the erection of Denver Sluices, both parties lamented the consequences of their destruction. Whatever effects may have been expected from the accident by those who had for so long, and perhaps for some cause, been justly opposed to the formation of these sluices, they were most grievously disappointed.

The silt deposited in the river Ouse to the depth of eight or ten feet in consequence of the formation of the sluices, and grown firm and compact by time, was not so easily removed. But the chief cause of the mischief remained: although the greatest part of the sluice was blown up and destroyed, the solid dam or wall, which was eight feet higher than the original bed of the river, was still left. A very considerable part of the spring tides, compared with the current before the destruction of the wall, continued to run up, but the neap tides could not reach so high as Denver, so that the benefit to the navigation anticipated from the admission of the tides through the ruins of the sluices was not realized. In this imperfect state of the drainage of the South Level this district became the very sink of the waters of the uplands and Middle Level, for in every wet season or land flood the waters coming down the Hundred Foot River, with a considerable current, necessarily found their way, their outfall being almost entirely silted up by the action of the flowing tides, to the lower places, so that instead of running towards Lynn and the sea, they took their course in the South Level, through the remains of Denver Sluice.

In the year 1726, another application was made to the Corporation by the proprietors of the South Level for the erection of Denver Sluice, stating, "That ever since the destruction of the sluice and the free admission of the tides into their flat country, as well as the reverting of the Hundred Foot waters, their lands were completely drowned." From time to time these applications were repeated, and many meetings took place between the Corporation and South Level Proprietors, those interested in the navigation, and the Corporation of Lynn.

The North Level Proprietors, the Corporation of Wisbeach, and others interested in the outfall of the River Nene, finding the proprietors of lands in the Middle and South Level adverse to the improvements necessary to render their outfall capable of discharging the water of those levels, and thinking that they would be obliged of necessity to discharge some if not all their waters into the Wisbeach River, and perhaps obtain the "first run" for their waters, turned their attention to the improvement of their river, and at length resolved to abandon Morton's Leam, and to make another river in the same wash of sufficient depth to carry off the water more rapidly. This new cut was executed in 1728 by Thomas Smith, a conservator of the Bedford Level, at the expense of the Corporation, and it is now generally known by the name of New Nene or Smith's Leam. It was a much more useful and successful work than Morton's Leam, but still a great part of the waters continued to run through Whittlesey Mere to the Ouse.

The South Level being still flooded, and the Middle Level partially drowned, the serious attention of the Board of the Bedford Level Corporation was directed to the re-construction of Denver Sluice, and several plans for improved drainage were delivered. These generally proposed the re-erection of the sluice at Denver, but the report which the Corporation was most inclined to adopt was that of Charles Labelye, then employed in the erection of Westminster Bridge. After a very lengthened historical account of the Fens, Mr. Labelye submitted his proposals, which will still be read with interest.

I shall now propose the best remedy I have been able to find for the relief of the Fens: in order to which, as it often happens that those who undertake too much succeed in nothing, I applied my thoughts towards finding what would relieve the lands in the Middle and South Levels of the Fens, and improve their outfalls to the sea by the port of Lynn, and postponed considering of a relief for the North Level, and the improvement of the other outfall of the Fens by Wisbeach, to another opportunity. The next step I made was to set down the several points or things which I was to attend to, and provide for, in framing a method for the relief of the Middle and South Levelof the Fens and the outfalls, which, after serious consideration, I reduced to the six following heads:

First.—It appears to me that the river Ouse, having 124 feet free water-way under Downham Bridge, and 95 feet a very little way above the remains of Denver Sluice; its free water-way being contracted by those remains to 79 or 80 feet at most, must be a great hindrance to the free descent of the land-waters after great rains, and consequently must hinder in some measure the good effect of those floods, in grinding and carrying away the lands silted in the river, and must also pen up the waters in the Fens longer than otherwise they would if the passage was wider, so that instead of contracting the river Ouse at Denver Sluice still more, I thought it absolutely necessary that it should be widened considerably, more especially when I considered that, according to my informations, the Old Ouse, after great rains, will rise by the land-waters two or three feet perpendicularly above the forelands; and in order to proportion the breadth of the Ouse at that place to what it is above and below, it appears to me the Fen water-way ought to be enlarged where Denver Sluice stood to about 100 feet wide. How I propose to do this will be explained hereafter.

Second.—As it is evident that the waters in the Fens which are not evaporated by the action of the sun and winds want a better outfall to sea than they have now, by reason of the bed of the river being here silted up about ten feet above what it was in 1650, I endeavoured to find what would deepen the river Ouse towards the sea, and consequently give a greater current to its waters; but I was sensible that this could not be done at once, and that the evil being a work of time, no remedy could be made to act instantly. Moreover, as I find two feet of sand silted up above the solid dam at Denver, I am very certain that no method or contrivance, except men's labour or engines, could deepen

the river above Denver lower than the natural slope or hanging level which the river had when it was only silted up to the top of that solid dam; that is to say, I am of opinion that the Ouse may be deepened above Denver about two feet, but no more as long as that dam subsists; and I have no reason to believe that as long as that dam subsists, the tides or the land floods, or both, or any contrivance, can ever deepen the river Ouse below Denver Sluice much more than those two feet. However, I am of opinion that if by the method which I am going to propose the river below Denver was deepened but two feet all the way to sea, this would not only clear the outfalls of the Middle Level into the Ouse, so as to give great and frequent opportunities to the rivers and drains in that level to discharge their waters in the Ouse, but that last-mentioned river, having thereby an increase of back-water, and two feet more fall, would have a much better current, and consequently greatly relieve the South Level, and also greatly improve the outfall and the navigation of the port of Lynn; and being further of opinion, that if the method I shall propose be duly put in execution, it may (and I verily believe it will) deepen the river below Denver two feet in a year's time, especially if that year should prove a wet one; and being certain that if this happens, there will be no great difficulty in improving that method so as to be able, in a few years, to restore the river Ouse and its outfall at Lynn to their former depth, I bent all my thoughts to the finding a practicable way to perform this operation of deepening the Ouse without men's labour or the use of engines, and I soon found that, instead of shutting out the tides, by letting them in and out at proper times jointly with the land-waters, by increasing their velocity, and by giving them a proper direction, I had (if not a certainty) at least a very great probability of succeeding, as I shall further explain hereafter.

Thirdly.—I considered that whatever method was made use of, some effectual remedy must be found to hinder the reverting of the land waters coming down the New Bedford River after great rains into the South Level, without contracting or hindering a free and ample passage to the waters of the Old Ouse, whenever they are not overridden by the tides, or by the New Bedford river, in which I found no difficulty, as I shall presently show.

Fourthly.—I found, by my observations and the information I received, that none of the neap tides ever reach Denver or the New Bedford rivers; that a common tide the rise of it is not above a foot or two at Denver or Salter's Lode, and that a common spring tide does not rise above three feet at the last mentioned places, but that it rises much higher in extraordinary tides, especially if attended with fresh winds from the N.W. to the E.N.E., from whence it plainly appears to me, that the free admission of common tides can be no damage to the South Level; but that the latter part of the rise or flood of those extraordinary tides overflows the South Level, and always will, till the rivers in it are much better embanked, or till some proper means be used to restrain only that part of those extraordinary high tides which does mischief, without restraining the far greatest part of the tides, which does no harm to the South Level, and are most powerful agents to keep the port of Lynn (or in other words the outfall of the Ouse) open. How I propose to do this shall presently be shown.

Fifthly.—The next thing which appeared to me ought to be attended to in any method that should be proposed is, that the navigation from Lynn upwards into the land ought to be preserved without any interruption, as well in the time that the Ouse is overridden by the tides, or by the New Bedford river, as when all the waters have their course towards the sea, in which I found no difficulty.

Sixthly.—The last thing considered is economy, well knowing the simplest methods are always the most acceptable, and, indeed, the most preferable, except where taste and magnificence are regarded, and therefore I have taken some pains in reducing as much as possible the expence attending the remedy or method which I am going to offer.

How I have succeeded as to contrivance or judgment, and how likely it is that these proposals (if put in execution) should answer the ends proposed in the articles just now mentioned, let the impartial reader judge.

Proposals.

It is proposed that Colonel Russel's two eyes or openings be cleared as low as the top of the solid dam, now lying about 2 feet under the bottom of the Ouse, in the remains of Denver Sluice, and the river so far cleared above and below as to afford a free passage to the land waters and the tides.

That a lock or new sluice be constructed on the east side of the easternmost of the two eyes of about 50 feet clear in the length, between the two pairs of breast gates which are to point down the river, and about 13 feet clear in width. That in the opening of the remains of Denver's Sluices, and in the two other openings or eyes, there be placed 28 draw-doors, from 3 feet to 3 feet 6 inches wide each, made so as to shut close upon the top of the solid dam, and properly supported, leaving a free passage for the tides of 87 feet in the clear, besides the 13 feet in the lock, which is 100 feet passage for the land-waters.

The uses of these works, and the advantages that are to be expected from the execution of these proposals, are as follows. All the draw doors are to be always left open for the free admission of all common tides, except at such times only as the waters coming down the New Bedford River, which is but another name for the One Hundred Feet River, override those of the Old Ouse, and during the last quarter of the flood, when the tides rise to such an extraordinary height as would overflow the banks or forelands in the South Level.

As soon as the danger of the waters on the Bedford river over-riding the river Ouse is over, or as soon as the extraordinary tides have ebbed so as to be no higher below the draw doors than the waters are there in the Ouse above them, all those draw doors are to be opened, in order to let the waters in the Old Ouse, and the rivers which fall into it, together with those of the New Bedford River and the other drains of the Middle Level, and what the tides had brought up in the lands, act jointly all together in carrying off the waters from both those levels, and scouring the river below Denver's and Salter's Lode. In order to which, careful persons must reside constantly upon the place, in order to watch the New Bedford River whenever it is expected its waters are likely to override and revert up into the old Ouse instead of taking their course down towards the sea, and also to watch the tides whenever any extraordinary spring tides are expected, the latter part of which only can do any mischief to the South Level, and no more of the tides should ever be hindered flowing into it. All which can very easily be managed without any danger or mistake, by making a few observations on a high spring tide, and making proper marks upon one of the standing ports of the draw doors, which should never be shut but in such cases of necessity as I have just now mentioned, and must all be drawn up as soon as the danger is over. Moreover, it will be very easy to increase the velocity of the waters down the Ouse, by shutting a pair of land gates just above the lock, and suffering the waters below the draw doors (when they are down) to fall about 6 inches lower than those above; but I would not advise to stay any longer, on pretence of increasing the velocity of the waters still more; because the consequence will be only this, that the waters will gull a hole just below the draw doors, and throw up a bar of sand a little lower. The advantages that will result from the execution of these proposals, and a careful management of its several parts, are as follows:

First.—The South Level will be secured from being overflowed by the latter part of the flood of any extraordinary spring tides, or by the reverting of the waters of the New Bedford River.

Second.—The waters coming down from the lands in and about the South Level, will have a much greater passage for their descent than they have had for many years since: instead of the present passage at Denver, which is 80 feet wide, and silted up two feet above the solid dam, there will be a free water-way 100 feet wide, and as deep every where as the surface of that solid dam, that is to say, two feet deeper than it is at present.

Third.—The tides will have their free and usual flow through a clear water way of 87 feet, which is 7 feet more than at present, and two feet deeper, except only that part of the latter end of the flood of very extraordinary ones, which at present overflows the lands in the South Level, and there remains for the most part stagnated, till the waters be evaporated by the sun and winds.

Fourth.—The Middle Level can no way be injured by the execution of these proposals, since the tides will not rise a hair's breadth higher in the New Bedford river, more than they do now; besides, tides always rise exactly, and never more than in proportion to the impulse which they receive from the sea. On the contrary, both the Middle and South Level have (if not a certainty,) a great probability, that the land waters and the tides being made to act jointly at all proper times, they will scour and deepen the river Ouse much better than they do now, and consequently that the current of the Ouse will be increased in proportion as a greater fall will be obtained by its being deepened.

Fifth.—The outfall to the sea, or the port and navigation of Lynn, must also be improved by the execution of these proposals, since not only the waters that used to revert from the Bedford river into the South Level, from whence little or none will be conducted through their natural outfall to sea, but all the land waters in the Old Ouse, and the rivers which fall into it, together with what the tides bring above Denver, will thereby be made to act jointly with those of the Bedford river and the other drains of the Middle Level, towards deepening the river and clearing it from the silt brought in by the sea, much more forcibly than they do at present.

Sixth.—The navigation from Lynn up into the country by the Old Ouse will in no wise be hindered or interrupted by the execution of these proposals; because a proper lock or pen sluice is therein provided, through which a vessel may always pass, and through which they will be able to pass almost at all times, without shutting the gates or penning

any water, since those gates are always to be kept open, except when the New Bedford river would (if not prevented,) override the Old Ouse, and for about one hour, or two at most, about the time of the high water of extraordinary tides, at which times, the draw doors being down, the breast gates of the lock will also shut themselves, and they will open themselves as soon as the waters in the Ouse can descend toward the sea.

As I know of no reasonable or material objections that can be made against the execution of these proposals, I shall hasten towards a conclusion, after observing, that their being put into execution will require much less time, and be attended with a much less expense, than any other scheme.

That it will afford the quickest relief I can think of to the South Level, without injury to the Middle Level, or the port of Lynn and the inland navigation: on the contrary, I am clearly of opinion that it will be attended with all the advantages just now mentioned, and perhaps with others which do not offer themselves to my mind at present.

That in case the method proposed be attended with so much success as to deepen the river Ouse, though it were but one foot or two from Denver to St Germain's (of which I have great hopes), Nature herself points out what is next to be done, in order to restore to the Ouse and port of Lynn their former depth, and to perfect the great work of draining the Fens.

That in case, contrary to my hopes (and all good men's hopes), this method should not be attended with all the advantages which may reasonably be expected from it, all the works mentioned in the proposals may be taken up, and the river Ouse restored to its perfect state in a very few days' time.

Lastly, I hope that in case the Honorable Corporation do put these proposals in execution, and find themselves as much relieved thereby as I wish and hope they will, I humbly recommend to their next future consideration the making or repairing the banks along the rivers of the South Level in particular, which, though a work that requires time and a very considerable expense, it is after all the safest and most natural way of preserving the lands in the Fens from being overflowed by the extraordinary tides and the land waters; for in the method now offered, or in any other method besides that of embanking, there can be no other provision made against the land floods, than by giving them a larger and deeper outlet to seaward, and in my humble opinion, to pretend that lands situated as low as the Fens are, particularly in the South Level, should not be overflowed by the land waters, or by extraordinary high tides, without embanking the rivers, is to pretend that nature should act differently in the Fens from what it does everywhere else.

'Rusticus expectat dum defluat amnis, et ille
Labitur, et labetur in omne, volubilis, ævum.'

I have nothing more to add, than to desire that my honest endeavours and disinterested views may be taken in good part, and to submit the whole of what I have said, or offered, to the serious consideration and judgment of the Honourable Corporation.

I remain, with all due respect, &c., &c.,

Crown Court, Westminster, CHARLES LABELYE.
August 8th, 1745.

It may be worthy of remark, that although Labelye, under existing circumstances, recommended the re-erection of the sluice, he by no means approved of the original plan of drainage unfortunately adopted by Sir Cornelius Vermuyden in reference to sluices.

In the year 1748, the corporation determined upon the re-erection of the sluice according to the plan delivered in by Labelye, and directed the sum of £3000 to be raised for carrying this plan into execution. Of this amount, John Duke of Bedford, then Governor of the Corporation, subscribed the sum of £500.

The sluice was completed in the year 1750, and continued in the same state until Sir John Rennie nearly rebuilt it in 1832, since which time it has stood as one of the many evidences of that gentleman's undoubted skill.

The beneficial effects anticipated from this work were not realized, for the water had neither a faster nor a deeper current. The country continued to grow worse and worse, and all parties began to consider more seriously the measure proposed by Mr. Kinderley, of making a straight cut from Eau Brink to Lynn; but the doubts and fears of timid persons prevented its execution, though almost every engineer recommended it, as absolutely necessary before any beneficial measures could be begun in the interior of the country.

In 1775, the Bedford Level Corporation, still feeling the necessity of doing something, engaged the services of Lieut. Page, of the corps of Royal Engineers, who delivered in the following Report:—

Observations on the present State of the South Level of the Fens, with a proposed Method for the better Drainage of that Country, made by the desire of the Right Honorable Lord Viscount Townshend, Master-General of his Majesty's Ordnance, and the Honorable the Corporation of the Bedford Levels.

IT appears from what has been written relative to the river Ouse, which is the great and NATURAL drain for the South Level of the Fens, that it was formerly a deep river, and answered perfectly well the purposes of DRAINING and NAVIGATION. At this time it is quite the reverse, it being from the Cambridge river to the Denver Sluice almost silted up, and its waters scarcely appear to have any current, except below such places as pen them back.

These observations are intended to point out, if possible, why the waters are so obstructed, as also to find some means of obtaining a better outfall to sea.

In order to which it is necessary to observe, that at this time the greatest part of the land on the south side of the river, from the Hermitage sluice to Burnt Fen, is under water, and has in a great measure been so upwards of ten years.

From a map in Sir William Dugdale's History, it appears that at the time of the general overflowing of the Fens, there was one continued lake from Salter's Lode to Cambridge river, which surrounded the high lands of Ely, and united near Erith. This proves that the greatest part of the lands in the South Level can have but little fall towards the sea, otherwise the waters could not have extended themselves in the manner they did, from which it may be concluded that the partial methods of lowering the waters by Slackers or Eaus, are of trifling use towards a general drainage. Nature has pointed out a way to carry the waters from this country, and it is in consulting her only that any great end can be obtained. The rise and fall of the tide at Lynn should be considered, as there is the great outfall, it being the difference from the common level of the land and low-water mark, which gives the fall of the waters of the river Ouse, to discharge themselves into the sea.

The point of low water should be considered as a centre, to which all the waters which lie higher in the country naturally incline, and the bottoms of the rivers ought to be directed to it in as regular a fall as possible.

Where the bed (or channel) of the river Ouse is brought into this state, little else will be necessary, as then nature will act with her utmost force.

A section should be made of the bed of the river from Erith to Lynn, to show the obstructions which actually resist and hinder the water from getting to its outfall, as finding out the impediments would be of great use towards obtaining a remedy.

After having taken notice of the state of the beds of the river, it becomes necessary to point out what the hanging level ought to be, to give the best vent for the waters.

I shall now consider the river from Lynn to the point where the Cambridge water falls into it, with a view to take away the obstructions, having a particular attention to the point of low water, and the fall the channel ought to have.

There are two ways, by either of which the hanging level in the part of the river may be obtained: the first is by confining the river within narrower bounds, and could this be done, the water in its course to sea would grind the bed of the river to a proper depth in a short time. This project appears in the first view to be impracticable, as it would be difficult to make banks to stand upon shifting sands. I presume, however, that it might be done by leaving the present banks in the state they are now, and making others in the inside of them, which need only to be made of sufficient height to keep the water in one channel, when the sea runs out at about half ebb, that being the time when the water has the greatest grinding force outwards.

This may be done in a simple and cheap way, as little more than fascines and stakes would be wanting; such works are not subject to be carried away by the violence of the run of water, and the elastic quality of the fascines would prevent the river from widening more than might be necessary, and as the greatest part of the work would be always under water, it scarcely would admit of decay, wood being only subject to rot from undergoing the changes of wet and dry. The other method, is that proposed by Mr. Kinderley (called Kinderley's Cut), which, instead of being carried from St. German's to Lynn, ought to begin at St. Peter's, as from thence the river would give it a much more direct course. There is the same fall from St. Peter's to Lynn by this new cut as by the river;

the advantage of it is, that it would undoubtedly be of service for the quicker discharge of the water, but as the flood tide at Lynn is only about three hours rising, and the ebb nine hours, it is right to consider how this difference of time might occasion the water to act against the sides and bottom of the cut.

I am of opinion, that if it had not at first receiving of the water a very considerable breadth and depth, particularly near the outfall, the run of water from the sea into it, being very violent, would carry great quantities of silt &c. from its sides and bottom, which might be dropped higher up the river, and as the ebb is so much slower than the flood, it probably would not have sufficient force to carry it out to sea. This danger might be the greatest in a dry season, upon a want of fresh water in the river to counteract the inlet of the tide. The expense of making such a cut will be an object for consideration, and if agreed to, it would be right to make it as wide as necessary and deep as possible, before the letting of the sea into it, to avoid the chance of the silt being deposited in the river, as dreadful consequences would follow such an accident. Although I in general condemn a winding channel where a straight one can be obtained, it has its advantages when the sea comes into it in a shorter time than it requires to go out again, as the crooked parts in that case serve to check its violence. On the coast of Hampshire I should advise a straight cut in preference to any other, for as the flood tide requires seven hours, and ebbs only five hours, there would be a greater chance of silt being carried out than of its being brought in. It is in that case the backwater which would be feared, whereas at Lynn it is the flood, or entering of the tide. The part from German's to the Denver sluice comes next under notice, and does not admit of complaint respecting the breadth of the river, but there is a want of water-way at each of the bridges, which is occasioned principally by the brushwood at the ends of them, which ought to be taken away, and as much archway added as the common breadth of the river requires.

As to the Denver Sluice, it certainly is the cause why the waters lie so heavy on the banks of the river above it, and why that river is so silted up, which arises from the want of water way both in breadth and depth. The river is in this place about 180 feet wide, and the greatest water way of the sluice does not exceed 86 feet. The threshold must be much lower than it is to bring the bed of the river to the necessary hanging level, and till this matter is rectified, the lands in the country above must remain nearly as they now are.

I am of opinion that this sluice might be so altered as to answer the desired end, if attended to with proper care and judgment, or, in case it should not answer, a new sluice might be made in a short time. That St. John's Eau was made to take the penned water which would not get vent by the sluice, but as it has no more fall than the river will have when the obstructions are taken away, and does not gain a shorter distance for that fall, I am led to prefer the natural channel of the river, as it is an established and good rule, that streams of water ought not be divided whenever other means will do. The gates of the Denver Sluice are sometimes over-rid by the water of the Hundred Foot river, but this does not often happen, and I can see no great harm that would attend such circumstance, as it is not a casual flood which hurts the Fens (that will happen in all rivers), but the remaining of the water upon the land, which will not be the case if the rivers can be made deeper and the waters lowered, which is the great end of these inquiries.

From this I conclude, that if the Denver Sluice remains as it now is, the St. John's Eau ought to be opened again, but under certain restrictions for the safety of the old river, and the Eau will, I think, not be wanted should the obstructions I have mentioned be taken away.

The river from Denver Sluice to Littleport is in good order and tolerably well embanked, but from thence to the Cambridge river it is much neglected; banks certainly should be made to keep the water within proper bounds, and to avoid a long and winding part dams should be made to force all the Ouse water down the new river, below Ely, instead of a part (as at this time), which would be joined by the Middenhall river above Littleport bridge, to which place that river ought to be carried within a narrower channel than the present one.

It is necessary to observe, that when the Cambridge river comes rapidly into the river Ouse, it frequently runs up towards the Hermitage sluice, and lays the lands near the old river under water. This happens always on the Cambridge river being in the least flooded. I would advise a pair of gates to be made to preven this happening for the future, which gates would be useful in continuing the navigation at this time.

The end of these observations is to cause the bed of the river Ouse to be brought to a regular fall towards the sea, which, in draining, is what nature directs, and is all that seems necessary to be done (at least prudently), towards a perfect drainage of this part of the Fens.

ON THE GEOLOGY OF EGYPT.

BY LIEUT. NEWBOLD, F.R.S., OF THE MADRAS ARMY.

(*Concluded from page 126.*)

A few specimens are imbedded horizontally in the sand and associated conglomerate, and a still fewer occur in a vertical position rising from 12 to 20 inches above the surface. Mr. Newbold cleared the sand from one of these stumps, and ascertained that its lower part was impedded in the subjacent conglomerate; but it exhibited no traces of roots.

The trunks, which are rarely flattened and never invested with coaly matter, are branchless, and in general knotless; though in some specimens Mr. Newbold traced places for the insertion of branches; roots also are wanting, but among the masses enclosed in the sand some were found, which bore strong resemblance to the bulbous base of palms, and others which assimilated to the tortuous roots of exogenous trees. Internally the trunks exhibit a concentric structure, though externally they resemble the present palms of Egypt. Some specimens examined by Mr. R. Brown were decided to be dicotyledonous, and not coniferous; but one brought from the Nubian desert by the Rev. Vere Monro is stated to exhibit that structure. Indications of a jointed appearance are mentioned, but Mr. Newbold is of opinion that this calamite or reed-like structure may be due to contraction during the process of silicification. Instances of decay at the time the trunks were imbedded the author alse noticed, the interior being partly filled with grit and conglomerate; and he mentions cases in which all ligneous structure had disappeared. The silicified wood varies in character from a white opake crust, which crumbles when handled, to agate and flint, and in colour from white to grey, brown, and red. No decided seed-vessels or traces of leaves have been found.

The author then describes the structure of Gebel Ahmar, situated on the northern limit of the "Fossil Forest," and of the intervening valley. Gebel Ahmar is an irregular ridge, a mile in length, and half a mile in breadth, rising to the height of about 150 feet above the general level of the desert, and it is composed of conglomerate, grit, and sandstone, the prevailing colour of the strata being red (Gebel Ahmar, Red Mountain).

The stone has been so extensively quarried, and the mounds of rubbish are so numerous, that the original outline of the ridge has been obliterated; and its present rugged, conical aspect is due to those causes, and not to a supposed volcanic origin. The sandstone reposes, as elsewhere, on the marine limestone, passing near the line of junction into an ochreous, reddish, and yellow clay, which contains lines of fibrous gypsum, seleuite, salt, and, it is said, barytes.

Both the sandstone and limestone abound in caverns, "the resort of the hyænas that nightly prowl among the burial-grounds, without the walls of Cairo. One of these dens, into which Mr. Newbold descended, contained the recent dung of the animal, intermingled with human and other bones."

The valley which intervenes between Gebel Ahmar and the "Fossil Forest" is excavated in the sandstone, the subjacent limestone being in some places exposed

The following inferences are drawn by Mr. Newbold from the phenomena presented by the deposit of petrified trees:—

(1.) He is of opinion that this part of Egypt has twice formed the bed of the ocean, and been twice elevated above the surface of the water.

(2.) That the fossil trees lived between these epochs, when they were submerged or drifted into the ocean, and were covered up by a bed of rolled pebbles or sand; and that they were afterwards raised to their present position.

(3.) That the elevation of the strata was effected gently and gradually, as the horizontal position is maintained.

(4.) The retiring water is supposed to have removed the looser portions of the once continuous strata, and to have dispersed them with fragments of the fossil trees over the surface of the Egyptien and Libyan deserts, constituting the present accumulations of gravel and saline sands.

(5.) From the little-worn aspect of the trunks, as well as the angularity and "nice adaptation" of many of the fractured portions near Cairo, it is inferred, that, in that locality at least, the specimens rest at no great distance from the spot on which they were silicified; and from the vertical position of a few of the trunks, that they probably occur where they grow; but until the vertical stems are traced down to roots fixed in a given stratum or at certain levels, marking, as in the Portland "dirt-bed," the ancient surface of dry land, Mr. Newbold hesitates to admit the hypothesis that the Cairo fossil deposit is the site of a submerged forest.

Reposing horizontally, and at the height of 300 feet, on the inclined limestone of the Gebel Ataka range which skirts the shore of the Red Sea below Suez, is a calcareous conglomerate, which Mr. Newbold thinks may represent the sandstone formation, as it rests on the marine limestone, and contains similar pebbles; but it contains no silicified wood, nor any other fossils, except such as have been derived from the subjacent limestone.

6. *Post-Pliocene Deposits.*—Around the head of the Gulf of Suez, as well as between the Red Sea and the cliffs which skirt its western shore, is an interrupted fringe rising in some parts to a height of 60 feet, with an extreme breadth of four or five miles, composed of calcareous deposits containing the remains of testacea, radiaria, and corals, which now inhabit the Red Sea. Kossier and several other towns stand upon this formation. It is suspected by some observers, on account of the obliteration or shallowing of anciently deep harbours, that the process by which the fringe was raised above the level of the sea is still in operation, and Mr. Newbold is of opinion that the forces which effected the upheaval acted gently and gradually. He objects, however, to the inference that the isthmus of Suez has been recently raised, on account of the difference in the faunæ of the Mediterranean and the Red Sea.

Among the post-pliocene formations, the author includes the accumulations now forming around the Red Sea and in the Mediterranean on the shores of Sicily, Greece, Asia Minor, &c. On the west shores of the Red Sea he has noticed them five or six times above high-water mark, overlaying a raised coral beach. They sometimes enclose bones of the camel; and in the island of Rhodes Mr. Newbold observed in a similar formation fragments of ancient pottery.

In the valley of the Nile, on the plain of Benihassan, myriads of Nummulites, washed from the overhanging limestone, are partially re-cemented by calcareous matter deposited from spring,s and form layers which alternate horizontally with others composed of clay, sand, and gravel, the whole in some places attaining a thickness of more than 30 feet. In the valley of Kossier, beds of gravel and other detritus are gradually becoming consolidated by a calcareous or ferruginous cement derived from percolating water; and in the cliffs skirting the Mediterranean, between Alexandria and Aboukir, Mr. Newbold observed a bed of bleached bones, derived from Roman and Greek cemeteries, with an intermixture of more modern human remains, overlaid by a layer of occasionally agglutinated sand or gravel, sometimes from three to four feet thick.

7. *Drift.*—Under this head the author includes, 1st, the saline sand and gravel of the deserts, derived in great part, he believes, from the fossil-wood sandstone formation, but generally much influenced in each portion of the deserts by the character of the rocks in the immediate vicinity; and 2ndly, the gravel beds which cover the raised coral beach of Kossier, and the limestone cliffs of the Red Sea near the Jaffatine group, also the detritus resting on the elevated platform of the Libyan Desert near Dendera, the materials composing the whole of which consists of far-transported plutonic and metamorphic pebbles, intermingled with others derived from adjacent formations.

8. *Volcanic Rocks.*—After alluding to the supposed volcanic cones or extinct craters in the desert between Cairo and Suez, and to others said to exist in the vicinity of Dakkeh, situated in the Nubian desert 69 miles from Syene, Mr. Newbold proceeds to describe the trap and porphyry dykes which in Upper Egypt penetrate all the rocks from the lower sandstone to the granite, and have been already noticed in the account of the formations through which they pass; the author, however, observes in addition, that the relative age of the trap is defined by the upper or fossil-wood sandstone being undisturbed, and by its sometimes containing pebbles of the trap.

Granitic or syenitic rocks are of rare occurrence in Egypt, appearing only at the cataracts of Syene, and in the desert between the Nile and the Red Sea, forming the anticlinal axis (lat. about 26° N.); and according to M. Trivin, still further north in the same desert, in about the latitude of Benisuof (29° 10′ N.). This locality, Mr. Newbold thinks, may be that mentioned by Savary. Sir G. Wilkinson has likewise traced them to lat. 28° 10′, where they form the peak of Gebel Tenaset; and the same author states that the extreme height attained by these rocks in Gebel Gharib (lat. 28° 10′) is 5000 feet above the sea.

Respecting the relative period of their elevation, Mr. Newbold is of opinion that it was subsequent to the deposition of the inferior sandstone and limestone which occur on their flanks in inclined strata, and prior to that of the superior horizontal sandstone. He is likewise of opinion that the plutonic rocks were upheaved through once continuous solid strata of sandstone and limestone, on account of the absence of granitic veins of those deposits, and the occurrence of breccias along the junction line of the igneous and sedimentary formations. He carefully examined the limestone and sandstone for imbedded pebbles derived from the granite or syenite, but without success. Granitic veins penetrate the gneiss.

9. *Alluvial Accumulations.*—These deposits Mr. Newbold describes under, 1st, the mud of the Nile, and 2ndly the Delta: but he alludes also to the vegetable soil of the Oases, to the detrital soil washed down from the rocks, and to the greyish soil accumulated generally around the ruins of ancient cities, due partly to the decay of animal and vegetable matter, partly to the mouldering ruins; likewise to the ammoniacal and nitrous salts formed in the deserts where caravans have halted, and which have been collected from the earliest times.

(1.) *Mud of the Nile.*—This accumulation varies with the nature of the formations over which the Nile flows, and is therefore, Mr. Newbold observes, not merely the result of the spoils of Abyssinia. To this cause he also ascribes the discrepancies in the analyses of the mud. Above Thebes, below the granitic and sandstone formations of Nubia, and on the southern limit of Egypt, it contains more silex and less calcareous or argillaceous matter than at Cairo, which stands on the great limestone deposit, and in the Delta, which rests on that formation. It varies also in texture and composition, according to its position relative to the main channel of the river and the force of the current. The finest mud, as that of Ghennah, is generally dark brown passing to lighter shades; it is also highly tenacious, retentive of moisture, effervesces, and fuses *per se*, with extrication into a greenish glass. The annual deposit or layer varies in thickness in the same situation from an inch to a few lines, the upper part being generally lighter than the lower; and each layer is separable from that above or beneath it; but the deposition of one year is frequently removed by the flood of the next.

Mr. Newbold does not know if the thickness of the mud in the centre of the river's bed has been ascertained; the greatest accumulation in a transverse section being near the stream's channel; but in Upper Egypt he has measured cliffs composed of it forty feet in height; and the average thickness in Middle Egypt is thirty feet, while at the apex of the Delta it is eighteen feet. According to Sir G. Wilkinson, the deposit has increased during the last 1700 years at Elephantine in Upper Egypt nine feet, at Thebes seven feet, and at Heliopolis five feet ten inches; but the amount of accumulation diminishes in general more rapidly towards the Delta and Mediterranean. All calculations, however, on the progressive rate of increase throughout Egypt, deduced from the actual addition around the bases of nilometers, statues, or buildings, in particular localities, are liable, Mr. Newbold says, to uncertainty, on account of the shifting of the river's bed, and the intermingling of the drift sand of the desert. Moreover, the alluvium at the foot of these monuments has been disturbed by the plough and spade of cultivators; and in most cases it has not been proved at what period the Nile reached these bases; but judging from the thickness of the annual layers, of which the author has counted upwards of 900 in the cliffs of the Nile, he concludes that the yearly deposition has not varied in the aggregate for the last thousand years. It is equally difficult, he adds, to calculate the progressive superficial extension of the mud.

Few pebbles or detritus of any size are found in Lower Egypt and in the Delta, and only the finest ingredients escape into the Mediterranean, but Mr. Newbold has observed the sea coloured by this drifted matter to the distance of forty miles from the shore. The northern or Etesian winds, which commence about May, or the period of the inundation, retard, he says, the downward freshes, and contribute materially to the accumulation of the mud upon the land, as well as to the silting up of the embouchures of the river, by raising the level of the Mediterranean along the coast, and checking the currents,in the estuaries. Near the mouths of the Nile the mud is intermingled with marine sand, and contains Mediterranean species of Mollusca, associated with terrestrial and fluviatile remains. According to Ehrenberg, the river mud contains an immense number of infusoria.

The action of the Nile on its eastern bank, arising from a difference in the level at the base of the Arabian cliffs and the prevalence of westwardly winds, is shown to be considerable. Many monuments of Koum Ombos have been carried away, and the remainder are threatened; further down, the ancient quay, and the temple at Luxor, are in great danger; and the ruins of Gou-el-Kebir have been in part destroyed by the encroachments of the river, the traditional channel of the Nile being nearly a mile to the westward. Other changes are also mentioned.

(2.) *Delta of the Nile.*—On account of the absence of all marine remains from the mud covering the middle and upper portions of the Delta, Mr. Newbold infers that the present alluvium must have been deposited, for the most part, on a surface previously above the level of the Mediterranean; and he is also of opinion that other causes than the deposition of mud have tended to the formation of the Delta. The coast-line, he shows, consists chiefly of banks of marine sand,

and a recent marine limestone: ancient Alexandria also stood on the calcareous rock of the Libyan desert, but the modern city is built on the recent marine sands and calcareous strata, occupying the position of the great harbour. Foah, which at the commencement of the fifteenth century was situated at the Canobic mouth of the Nile, though now a mile from it, and the present inland position of Rosetta, Micopolis, and Taposiris, Mr. Newbold says, must likewise be ascribed, in great measure, to the intervention of marine sand-banks.

The increase of soil from the waters of the Nile is much slower in the Delta than in the valley of the river, being spread over a much greater extent; and though a considerable quantity of the suspended matter is carried into the Mediterranean, yet the author does not think that the submarine accumulation of the Delta can be very rapid.

10. *Sand-drifts.*—At a short distance from both the Red Sea and the Mediterranean, the shores are occasionally studded with dunes or hills derived chiefly from the drifting of sand-banks thrown up by the waves. In considering the nature of the sands of the deserts, and their encroachments, the author dwells upon the effects of the strong north-westerly and westerly winds, which blow during nine months of the year; and on the agency of the little whirlwinds which prevail chiefly in the hot season, and transport not merely the finer particles of sand, but seeds of plants, and marine, fluviatile and land shells. With respect to the effects of the sand-flood, the author alludes to the more considerable encroachments and to their increasing influence, likewise to the natural impediments to their progress presented by the rugged ravines and cliffs of the western desert, and by the Nile: and lastly, he states that the accounts of whole caravans having been overwhelmed by clouds of drifting desert-sands are greatly exaggerated; the effects having been confined to infirm or over-fatigued travellers and animals who were unable to keep pace with the caravan.

ON THE RECENT GREAT MINING OPERATIONS NEAR DOVER.

BY MAJOR-GENERAL PASLEY.

SIR,—HAVING had frequent questions put to me in conversation respecting the great explosion near Dover, by which Rounddown Cliff, an immense projecting mass of chalk in the proposed line of the South-Eastern Railway, was thrown down, I request your insertion of the following statement, in order to correct several inaccuracies in my own letter to you of the 23rd of January last, which I wrote in haste, that it might appear in time to remove the impression which I found generally prevailed, that the whole operation was under my direction, but which I considered only a vague report, until I saw it quoted from an article in the *Railway Times;* which quotation did not come to my knowledge until three days before the time appointed for the firing of those great mines.

To Mr. W. Cubitt, the engineer in chief of the South Eastern Railway, is justly due the merit of having conceived the idea of removing a mass of chalk rock, nearly 300 feet in length, but of still greater height, and averaging 70 feet in thickness, by simultaneous explosions of gunpowder, instead of employing labourers to scarp it away, which would probably have cost nearly £8,000; and the merit of success also belongs to him, inasmuch as he took the most judicious measures to ensure it; but, as he informed me that he never would have contradicted the reports which ascribed the entire superintendence of that great operation to me, and as he is not likely to publish anything on the subject, I am desirous not only of correcting the inaccuracies in my first letter to you, but also of supplying the omissions in the printed accounts, by noticing the useful labours of those who contributed to his success, which I have always made a point of doing, in every similar operation that has taken place under my own direction, and which, I am sure, that Mr. Cubitt would do if he wrote himself, as I know from the able resident and assistant engineers of the same railway, that instead of assuming the whole merit of the works in which they have been employed under him, he has always been ready to acknowledge their services in the most liberal manner, both officially to the directors of the company and personally in conversation, as I have witnessed myself.

The general impression, that the mines near Dover were to be superintended by me, no doubt arose from its being known that Mr. Cubitt always intended to consult me, and that he would not, and did not, decide upon his plan of operation until he had taken my opinion; and it was also known that he relied upon my assistance for firing his mines simultaneously by the voltaic battery, of the use of which, as applied to mining, neither he nor his assistants had had any practical experience. Accordingly, I went to Dover by his request, and introduced Lieutenant Hutchinson, of the Royal Engineers, who had been employed two summers under me in the operations against the wreck of the Royal George, and who happened, fortunately, to be on duty at that place at the time, so that I recommended him as the most proper person to superintend the firing of the proposed mines by the voltaic battery, provided that the permission of the Master-General of the Ordnance could be obtained to enable him to undertake this service, which was readily granted, on application being made to Sir George Murray by the railway company.

Accompanied by this officer, I examined the drawings of Rounddown Cliff, that had been prepared under the superintendence of Mr. John Wright, the resident engineer of this portion of the railway, to whom Mr. Cubitt referred me on the 10th of November last, and went with him into a drift, or small gallery, cut entirely through the cliff, and about 248 feet in length, which had originally been intended for the commencement of a tunnel through which the railway was to pass; a design that was abandoned afterwards on discovering that this part of the cliff was likely to give way sooner or later, and the plan of removing it by gunpowder was adopted in consequence. Shafts about 17 feet deep had been sunk from this gallery, and branches driven from the bottom of them further into the chalk, in order to obtain greater lines of least resistance, on the level of what would have been the bottom of the proposed tunnel, and agreeing with the position of the rails. Mr. Cubitt had previously told me, that his rule for estimating the quantity of gunpowder for explosions in chalk, was to use half an ounce for each foot of the cubed line of least resistance. As he talked of having charges of from 5000lb to 6000lb or 7000lb, I could not but be surprised at this unusual mode of estimating such very large charges by halves of ounces; but, on going to the spot, Mr. Wright explained the mystery by informing me that he had, by Mr. Cubitt's direction, fired four experimental mines in the course of the year, in which, having had no previous personal experience, he adopted the rule laid down by Major-General Sir John Burgoyne, formerly of the Royal Engineers, and now President of the Board of Public Works in Ireland, for blasting in hard rock, which, as the line of least resistance in rock seldom exceeds a few feet, it was more convenient to determine in parts of an ounce than in pounds: and he also adopted Sir John Burgoyne's recommendation in his printed paper on blasting, by firing those mines with Bickford's fuses, which is an excellent expedient for blasts in rock, and inferior only to the voltaic battery, but such as I never would have used for mining. For example, Mr. Wright's first experimental mine, fired on the 5th of March, 1842, had a line of least resistance of 25 feet, was loaded with 500lb of powder, had a tamping of 50 feet, and was fired with 100 feet of Bickford's fuses in two lengths. His three other mines, the largest of which had a charge of 1,100lb, were each fired by 50 feet of Bickford's fuse. It is difficult to conceive anything more tantalizing than these arrangements must have been, for I calculated that 100 feet of Bickford's fuse would burn nearly an hour, and that 50 of the same would burn nearly half an hour, before the explosion took place. Nothing can be more teasing than such suspense. Our practice in the Royal Engineers, before we began to use the voltaic battery, was very different, as we never allowed a greater interval between the lighting of the portfire or fuse, and the ignition of the charge than from one to two minutes, being just enough to allow time for the officer or non-commissioned officer who fired the mine to retire to a distance sufficient for his personal safety. In all his experimental mines, which were fired singly, and independent of each other, Mr. Wright found, that the rule deduced by Sir John Burgoyne with great care and skill from numerous experiments tried by his direction, in order to ascertain the proper charges for blasts in hard rock, which had heretofore been left to the discretion of the miners or quarrymen, and which in practice seldom exceed a few ounces, were equally appropriate for mining in solid chalk, in which the charges, calculated according to the above rule, produced moderate demolition, without throwing the fragments to a distance, an object always desirable, except in military mines, having not merely demolition, but destruction in view. After having had this matter explained, I again inspected the plans and sections of Rounddown Cliff, and, considering the length of the gallery, and the proposed lines of least resistance, two of which were to be about 56 feet, I was of opinion, from my own repeated experience in conjunct mines, which had not as yet been attempted by the engineers of the South-Eastern railway, that two mines only, with charges calculated to effect moderate demolition, could not possibly throw down the whole of the cliff. I therefore approved of three charges, to be placed at equal distances from each other, but the two extreme charges to be nearer to the ends of the gallery than to the intermediate charge in

the centre of it; and as I thought that Sir John Burgoyne's formula must be calculated rather for very moderate, than for immoderate demolition, I was of opinion that the distances between the three charges should be somewhat less than two-lined intervals, which our own experiments on conjunct mines had established as the most proper for moderate demolition. In case of using three charges, Mr. Wright informed me, that whilst the line of least resistance of each of the two extreme mines would be 56 feet, that of an intermediate mine between these two would be about 62 feet, which lines required two charges of about 5,500lb, and one of about 7,500lb, if calculated according to the above formula, without reference to their distances apart. This last point had not yet come under the consideration of the engineers of the South-Eastern railway, who had only fired single and independent mines, as was before observed.

On giving my opinion first to Mr. Wright, and to Mr. Hodges, his assistant, and afterwards to Mr. Cubitt, the latter objected, and as I admitted on good grounds, to the extreme mines being moved nearer to the ends of the gallery, although this arrangement had been adopted by me with perfect success in all my conjunct mines, because he apprehended that this would cause the fragments from those two mines to be thrown out laterally on each side of the Round-down Cliff, in the direction of the gallery, prolonged so as to obstruct the proposed line of railway, more than if the whole were projected forward towards the sea. At the time when this conference took place, I did not know how many mines were prepared, as I had only gone down one shaft, and into one chamber to examine, but did not walk through the whole of the gallery, so that the impression on my mind was that three chambers were then in readiness for the intended explosions, which was confirmed by my afterwards hearing that three charges corresponding with the lines of resistance then mentioned to me, had actually been adopted, and therefore, when I wrote to you on the 23d of January, it was natural for me to believe, not only that every arrangement had then been previously fixed by Mr. Cubitt, subject to my approval, but that all the three chambers were actually ready for receiving the gunpowder, and only waited for the voltaic apparatus, which had all to be made, as I recommended, in preference to borrowing.

I have since been informed by Lieutenant Hutchinson, that I was so far mistaken, that only two chambers were prepared at that time, so that the third shaft, with the branch and chamber leading from it, were excavated subsequently to my visit to Dover, and also that the position of one of the first two chambers was altered after the same period. Eventually the three chambers were placed at only 70 feet apart, thus dividing the length of the gallery into four equal parts, but the line of least resistance of the central chamber, on placing them all in the same allinement, proved to be 72 feet, which would have required a charge of nearly 11,700lb., according to Sir J. Burgoyne's formula, and yet the original quantity of powder calculated for 62 feet was not altered. These arrangements were thus definitively made, not before, but after my visit to Dover, at the suggestion of Lieutenant Hutchinson, after he had been placed in charge of the proposed mines; and were very judicious, because the chambers being only 70 feet apart were at much less than two lined intervals, even in reference to the shortest of the lines of least resistance (56 feet) above mentioned; and in this case, if the central charge had been estimated upon the same formula as the others violent demolition would have been produced, which was not desirable. In short, the same rule invariably adopted by us in the Royal Engineer department, in respect to conjunct mines, was here followed—namely, to diminish the regular charges, which are known to be capable of effecting moderate demolition, whenever they are placed at much less than two-lined intervals apart. Though this term is very generally understood, yet perhaps it may not be superfluous here to explain, that in speaking of conjunct mines, the term "two-lined intervals" implies that the central distance between adjacent charges is twice the line of least resistance of each, the latter being the distance from the charge to the nearest surface of the rock or mass that is to be removed by the explosion.

The whole of the arrangements for firing these great charges by the voltaic battery were made by Lieutenant Hutchinson, assisted by Lance Corporal John Rae and private Thomas Smith, of the Royal Sappers and Miners, and by two naval pensioners, John Leary, a blacksmith, capable also of working in tin or copper, and William Gordon, a rigger, all of whom had been employed under the same officer at Spithead, and who in their several capacities understood thoroughly every thing relating to the preparation of charges and to the mode of firing them by the voltaic battery. Leary, who is an excellent workman, and who distinguished himself some years ago whilst under the command of Captain Dickenson of the Royal Navy, by converting ships' tanks into a diving-bell, by means of which that enterprising and intelligent officer recovered the treasure sunk in the Thetis frigate on the coast of Brazil, was employed on his arrival at Dover in making voltaic batteries for the proposed explosions, nine in number, each consisting of six cells of Professor Daniell's constant battery, such as had been used by me in all my mining operations, and he also put together the wires for three conducting apparatuses, each 1,000 feet in length, and consequently composed of 6,000 feet of copper wire. Each apparatus consisted of a pair of wires attached to a strong rope, and secured and insulated by Pensioner Gordon in the same substantial manner that had been adopted by us at Spithead, for though there was very little necessity for guarding against the action of water, yet the letting it down and dragging it up the high chalk cliffs exposed this apparatus to a good deal of wear and tear; and it might also have been injured by the hob-nailed shoes of railway labourers to which it was continually exposed, as I observed particularly on the day it was used, when every person who came near it trod upon it, and which, had it not been thus protected, might have destroyed the connexion and prevented the explosion, of which I have known instances in the course of our former experiments. As soon as the batteries and conducting apparatus were complete, Lieutenant Hutchinson tried experiments to ascertain whether he could fire all the three charges simultaneously by one powerful battery, as had been done by Dr. Hare, of Philadelphia, who first applied voltaic electricity to practical purposes, by using it for blasts in rocks to obtain stone for building in 1831, as minutely described in Silliman's *American Journal of Science*, vol. xxvi. p. 352, and also briefly noticed in the Transactions of the British Association for the Advancement of Science, held in Bristol in 1836. From his own experiments, tried with this object, Lieutenant Hutchinson drew the same inference that I had done about three years before, namely, that one cannot depend upon more than two charges exploding simultaneously, for though by a battery of extraordinary power he succeeded in firing twelve small experimental charges at the distance proposed for the great mines under his direction, yet there was a perceptible interval of time between the reports, which resembled a volley of musketry rather than the discharge of a single gun. He therefore determined to adopt the plan which I had proposed to use in 1839, had it proved advisable to fire four subaqueous charges simultaneously against the wreck of the Royal George, namely, to have a separate voltaic battery for every charge, and a person at each, with one conducting wire fixed to a pole of the battery, and the other in his hand ready to complete the circuit, according to the time marked by the chief, who was to give the words —*one*—*two*—*three*—with an interval of about one second between each, and then the word *fire*, which was to be the signal for completing the circuit; and by this mode I expected that the explosions would all take place simultaneously, on the principle of marking time in music. The powder in each of the three chambers prepared for the several mines at Dover was contained in bags, placed in a large box, the former expedient having first been adopted in the practice of the Royal Engineers at Chatham; but we never used box and bags also, which I considered superfluous. As these boxes formed what may be called double cubes, Lieutenant Hutchinson very judiciously had a couple of short branches forking out from the lower extremity of each conducting apparatus into two central points of the oblong charge. Very short and fine pieces of platina wire wire were placed, according to custom, near the closed ends of strong tin tubes fixed to the outside, and leading into the centre of the powder-boxes, in which tubes bursting charges of fine powder were introduced, surrounding the platina wires, on the same principle that had been used at Spithead, but without those extreme precautions that had been found necessary to resist the great pressure of water to which our charges there were subject.

In the course of Lieutenant Hutchinson's experiments an unforeseen difficulty occurred, owing to Daniell's batteries, which had been very promising, losing their power after the first frosts set in. This difficulty had never embarrassed us before, because in our experiments at Chatham we always took the battery out of a warm room, and it required a longer time to impair its power than our experiments there ever occupied; and at Spithead, where Lieutenant Hutchinson first used the battery, it was generally kept in the cabin of one of our lighters; besides which the work was only carried on during the summer months. He was therefore obliged to have a small wooden shed built for his batteries at Dover, and to keep fires lighted whilst using them, by which he got rid of the difficulty.

I have since been informed, that in experiments tried at Calcutta a very energetic battery lost half its power when the temperature fell from 120 to 60 degrees Fahrenheit. When this difficulty occurred, a prejudice was naturally excited against Daniell's battery, and four very powerful plate batteries were ordered at Dover in consequence, which were made by an intelligent tradesman of that town. The trough of each of these contained 20 cells, according to Dr. Wollaston's construction, with zinc and copper plates, measur-

ing 7 by by 10 inches, the latter of which only were let down into the trough when the battery was about to be used; and these plate batteries were combined with the batteries made by Pensioner Leary as before mentioned, so that one very powerful battery, consisting of 40 plates of the common system, and of 18 cells of Daniell's constant battery, was to be used for each of the three great charges. But here I must remark upon a great inaccuracy in my letter to you of the 23rd of January last, in which I stated that the length of conducting wires about to be used at Dover was far greater than had ever been used by me either at Chatham or at Spithead, instead of which the contrary was the fact; for on referring back to the journal of our experiments at Chatham, I find that we fired an experimental charge on the 7th of July, 1839, at the distance of 1,950 feet, by 14 cells only of Daniell's constant battery, as recorded in the *United Service Magazine* for January, 1840, being more than twice the distance at which the great mines at Dover were afterwards fired by batteries of three times that magnitude, and at a temperature which could not have been less than that of our experiment. I said twice the distance, because the conducting apparatuses for the charges at Rounddown Cliff, originally each 1,000 feet long, were afterwards reduced to less than 900, their former length being unnecessarily great. I thought it right to rectify this error, lest a prejudice should be excited against Daniell's constant battery by its supposed inferiority, which led to the employment of plate batteries at Dover, in addition to those of his pattern, which were first made. At the same time, I am now of opinion that the plate battery is the most convenient of the two for firing gunpowder, and the simplest that I have seen is that which is now being used by Mr. R. Davidson, of Aberdeen, in his interesting exhibition of electro-magnetic power at the Egyptian-hall, Piccadilly, which I visited lately in company with Dr. Faraday and Mr. Brand. This battery, which contains 20 cells, differs from Dr. Wollaston's in using amalgamated zinc, and in substituting plates of iron instead of copper, all the plates measuring 8 by 11 inches, and the action being produced by diluted sulphuric acid, upon the purity of which, Mr. Davidson says, the efficiency of his battery chiefly depends. On inquiring who first adopted iron plates instead of copper, Mr. Davidson assured me that he had used the former metal himself for about 20 years, but that the merit of this arrangement was disputed between Mr. Sturgeon and Mr. J. Martyn Roberts, with whom he himself had not thought proper to contest it. Dr. Faraday observed, that articles published in any public or scientific journal afforded the only genuine grounds for deciding upon priority of inventions, for the same idea might occur to several persons, and the individual who worked in private must give way to those who published. On this plea, I advise those who ascribe the merit of applying the voltaic battery to the purposes of blasting in earth or rock, or the peculiar construction and management of the first plate battery, well calculated for this purpose, to any of our own countrymen, to refer to the documents before quoted, and they will find they are doing an injustice to Dr. Hare, of Philadelphia. But it must not be forgotten, that Mr. William Snow Harris of Plymouth was prior even to Dr. Hare, having fired gunpowder by electricity in March, 1823, which he effected to the astonishment of numerous spectators by a common electrical machine, from the cabin of a small vessel at anchor in that port, whilst the charge was placed in another at a considerable distance, and separated from the former by the water, through which his conducting apparatus passed. But the electrical machine, though perfectly efficient, never would have superseded the common mode of firing mines, as the voltaic battery has done, because the former not only requires a much more delicate manipulation than could be expected either from civil or military miners, and would be more easily broken or deranged, but it also requires artificial heat at all times, even in summer: whereas the voltaic battery can always dispense with this very inconvenient arrangement, even in the depth of winter, excepting in the case of very long exposure to a low temperature, which can seldom occur.

To return from this digression to the mines near Dover. By the 26th of January, the day appointed for the explosion, all the great charges had been placed in their respective chambers, with the two small bursting charges in the centre of each, whilst the conducting apparatus were led thence, two out of the east, and one out of the west end of the gallery, to the summit of the cliff, about 300 yards beyond the edge of which they were united with their respective batteries. These were placed alongside of one another in the shed before mentioned, in which powerful charcoal fires were kept burning, one near each battery. The mines had been tamped by filling up the branches and shafts, and 10 feet of gallery on each side of the shafts with rammed chalk, but leaving a vacant space of several cubic feet at each chamber, which had not usually been done by me, as my first experiments left me in doubt whether any advantage was obtained from this arrangement. Before the hour appointed for the explosion, the three voltaic batteries, each consisting, as before mentioned, of 40 sets of Wollaston plates, and 18 of Daniell's, had been got ready by Lieutenant Hutchinson, assisted by Lance Corporal Rae and Private Smith, who had been specially employed under him all last summer, in preparing and firing the numerous subaqueous explosions at Spithead. Mr. Wright and Mr. Hodges, who had been present at, and assisted Lieutenant Hutchinson in, his preliminary experiments, were now each stationed at one battery in readiness, whilst that officer himself took post at the third, to give the word of command.

The position of the spectators, and the signals for firing, &c., have been so well described by your own reporter, as well as by Sir John Herschell, in the *Athenæum*, and in other papers of the day, that I shall only remark that considerable anxiety was caused by the unexpectedly long intervals that elapsed between the first and second signals, which led the spectators to apprehend that something had gone wrong or been forgotten. At last the second signal was made, and the third signal for firing followed at the appointed interval. At this moment the lower part of the cliff was seen to swell or bulge out, immediately after which the top of it descended gradually, whilst the bottom also was put in motion, and flowed slowly towards and into the sea, spreading out at the same time to more than its original width; and as it approached and filled up part of the water, a black margin was observed issuing from the extreme outline of this extraordinary stream of white chalk, which was at the time apparently in a fluid state. No smoke was perceived anywhere, unless the dark border, of which no trace remained afterwards, was such. I neither heard a report, nor felt a shock myself, nor had I anticipated any, from the small quantities of powder used, that is, comparatively small, in reference to the depth at which the charges were buried; but the former was perceptible to many of the spectators of more acute hearing, and the latter was felt also, and described as a slight tremulous motion of the earth by some of them. It was particularly noticed by those who were seated on the ground near me, at a high point of the cliff to the westward, which commanded a flanking view of Rounddown. I would have preferred standing much nearer, and indeed a person at the distance of 50 yards from the edge of Rounddown Cliff itself would have been perfectly safe, but it was impossible to have a good view except from a distance. Lieutenant Hutchinson and his assistants lost the sight, and as they felt no shock, and heard no explosion, they were not without some apprehension that their mines had failed, until they rushed out of the battery-house, and heard the repeated cheers of the delighted spectators, amongst whom the hardy railway labourers, who are chiefly men of Kent, were not the least vociferous. The cause of the delay between the first and second signals was now explained to me by Lieutenant Hutchinson. One of the three batteries, when tested by the voltameter, proved inactive, and therefore there was reason to fear that the conducting apparatus of one charge might have been deranged. But on a closer investigation, it was found that a zinc rod in one of Daniell's batteries had broke by some accident, at which I was less surprised, because I had previously remarked on the very bad quality of the zinc supplied from London, of which these rods had been made. On discovering this defect, that battery, consisting of six cells, was set aside, and the connexion was made by the remaining 12, combined, as before stated, with 40 sets of Wollaston plates, a power of battery even then far exceeding what was absolutely necessary; but it is best on great occasions to employ a superfluity of power, as I myself have always done.

Soon after the sort of volcanic movement caused by the explosion had come to an end, we observed from the top a great number of spectators, who had stood below at a respectful distance from the foot of the cliff, but who now ran and spread themselves over the masses of chalk that had been moved towards the sea, and covered a large space of ground. These persons appeared like pigmies from the high and distant point whence we viewed them, and the moving stream of chalk which flowed towards the sea when seen from the same point, had previously appeared as if it had been crumbled into white powder, for no part of it seemed larger than the usual size of beach shingle, and the inequalities on its surface were imperceptible; but on descending the cliff, and examining the *debris*, we were surprised to find that they consisted of large irregular fragments of all sizes, some of which must have weighed more than a ton, and which were heaped up or packed on some places to the height of about 30 feet, but more spread out in others.

Here and there we found fragments of earth and grass that had originally covered the top of the cliff lying upon those rugged masses of chalk below, which, when seen from above, had appeared like dark brown spots on a white ground. As it was extremely troublesome and fatiguing to walk over the *debris*, for the smaller lumps of chalk rolled under the foot, and the larger ones could not be ascended or passed without an effort, several persons went down

to the beach in order to go entirely round them, it being then low water, in which they afforded some merriment by sinking up to their middle, or falling down in crossing some little quagmires of very fine chalk and mud, with small temporary streams flowing through them from the bottom of those great masses, which had prevented the whole of the water of which they took the place from escaping quickly as the tide fell. A flagstaff had been placed at the summit of the cliff before the explosion, which was found prostrate, but uninjured, at some distance from the bottom of it, and was set up again with a flag of the same colour, on the spot, by the railway labourers. I observed a considerable portion of the voltaic conducting apparatus, which had also been thrown down; when afterwards collected and opened, for very little of it was lost, the copper wires were found to be much injured by the kinks occasioned in its fall, but externally it had appeared perfect. That the ruins of the chalk cliff thrown down by this great explosion should have covered 15 acres of ground, may appear surprising, or even incredible to many, as, from recollection, it did to me, until I was assured that an accurate survey of it had been made by Mr. Hodges, of which such was the result. The new face of the cliff produced by these great mines, was nearly parallel to the original slope, but of a more regular form, being nearly a plane surface, except at the bottom, where a proportion of small chalk rubbish brought down by the explosion is piled, at a greater slope, against that which still remains solid.

Gratified, as they could not fail to be, by the splendid results of an operation, that probably did not save less than £7000, the chairman and directors of the South Eastern Railway Company addressed a letter of thanks to the Master-General and Board of Ordnance, on the 16th of February, "for having allowed Lieutenant Hutchinson, of the Royal Engineers, assisted by Lance Corporal Rae and Private Smith, to make the arrangements for, and superintend the firing of the great mines at Dover, on the 26th of January, by which the entire removal of Rounddown Cliff was completely effected;" and further observing, "that the important operation referred to having been accomplished by the voltaic battery with a degree of skill as gratifying to the directors of the company as creditable to the talents of Lieutenant Hutchinson and those acting under his directions, they solicited the permission of the Master-General and Board, that Lieutenant Hutchinson might be allowed to receive from the company a piece of plate, which the directors were desirous of presenting him with, in token of the high estimation in which his valuable services on the memorable occasion referred to were held by them."

This proposition having been acceeded to by the Master-general and Board, "as a special case," for it is contrary to etiquette that the services rendered by an officer of the army should be noticed by any mark of approbation except by his own superiors, if performed as a part of his military duty, or by their permission, if otherwise, —as soon as this was communicated to them through Mr. Byham, the sum of fifty guineas was expended by the Chairman and Directors of the South-Eastern Railway Company in this testimonial of their gratitude to Lieutenant Hutchinson.

Finding the immense benefit of this great explosion, Mr. Wright and Mr. Hodges, by the approbation of their chief, have since fired several other mines with equal success in the same range of chalk cliffs by the voltaic battery, of which they acquired a thorough knowledge, as well as of the general principle by which conjunct mines ought to be regulated, whilst under Lieutenant Hutchinson—viz., two mines of 750lb each on the 10th, and two of 900lb, each on the 14th of February; after which, on the 2nd of March, they fired eight conjunct mines, all in the same line, in which they expended 6,440lb of gunpowder, along a range of cliff of such very irregular outline, that they varied their charges from 200lb to 2,000lb. Mr. Hodges has contrived a simple and ingenious apparatus for completing the circuit of several voltaic batteries at the same moment by one operator; and they propose to fire more than 12,000lb of powder, distributed amongst fifteen or sixteen conjunct mines, in order to remove another portion of the same cliff, on the 18th instant. In short, these gentlemen, who had no knowledge of this art a year ago, have profited so well by their opportunities, that I consider them capable of planning and executing any mining operation, however extensive, with skill and success. In respect to conjunct mines calculated for a scale of moderate demolition, I shall here remark, that it is not absolutely necessary that they should all explode at the same moment of time (which is difficult even by the voltaic battery, but by all the former methods of firing gunpowder absolutely impossible, though the contrary has been asserted by writers copying from the old French authors on military mining.) For example, in the course of our experiments at Chatham, before we knew the use of the voltaic battery, we first demolished a brick wall about four feet thick by blasts fired successively by a very small powder hose leading along the back of the wall, and connected with each charge, one end only of which hose was ignited. In like manner Lieutenant, now Captain James, of the Royal Engineers, acting under my direction, demolished 466 feet in length of the brick revetements or retaining walls of an entire front of the old fort of Sheerness, with the exception of one of its flanks, but including its ravelin, with such complete success, on the 14th of July, 1827, that the brickwork was as it were just turned over nearly on the same spot, but crumbling into pieces as it fell, without any of the fragments being thrown to a distance, although no two of the explosions were simultaneous. In this operation 15 charges, generally of 84lb, but some of 90lb, in barrels, were used against the demibastion and curtain, whilst 23 charges of 25lb each, placed in bags, were used against the ravelin. The former were grouped by twos or threes as conjunct mines; the latter were all fired one after another, at intervals of several seconds of time, by igniting one end of a longitudinal hose laid along the top of the wall, and communicating with separate vertical hoses leading down into the several charges. But though simultaneous explosion is thus evidently unnecessary in conjunct mines having their charges calculated to effect moderate demolition, yet in the case of violent demolition, absolute precision is indispensable, otherwise the explosion of the first charge may derange the others, and either diminish the general effect of the whole, or even cause some of them to fail altogether, of which I have known instances.

The great explosions which took place at Dover on the 26th of January last are certainly the triumph of the art of mining in this country, but the British military engineers, by whom undoubtedly it has been brought to perfection, were not so fortunate in their first attempts as the able civil engineers of the South-Eastern Railway. Owing to the inefficient state of the Royal Engineer Department at the commencement of the present century, which was not improved until towards the close of the Peninsular war, the officers had no opportunities of acquiring practical knowledge in this important art. Hence in Sir John Moore's retreat all the mines of demolition made for the destruction of the bridges in our rear failed, excepting one, in which Lieutenant Davy, a most promising young officer, blew himself up along with the bridge that he destroyed; and I myself was one of the unsuccessful operators in that campaign in an undertaking in which no non-commissioned officer and very few privates of the corps would now fail. At the siege of Badajoz, Captain Stanway, a most gallant and intelligent engineer officer, succeeded in placing a charge to blow up a dam that retained an inundation, which was a great impediment to the besiegers, but the explosion failed, from the mode of securing charges against the pressure of water not being then understood; and in the attack of Burgos the work of the British miners was obliged to be suspended from time to time for want of air, because the simple method of ventilating military mines was not known. Towards the close of the Peninsular war, however, the distinguished engineer officers employed in it had acquired more experience, and none of their mines of demolition against bridges, &c., failed as at first.

In India, where the same defects prevailed, perhaps to a still greater extent, the first mining operations after the commencement of the present century were not merely unsuccessful, but calamitous, for at the siege of Cumoona, an insignificant little mud fort, in 1807, the company's engineer officer, whilst preparing mines to throw down the enemy's counterscarp, was himself blown up in his own gallery, by the native miners opposed to him, and our troops were afterwards repulsed with great slaughter in an attempt to storm the place, which, however, was afterwards evacuated in the night. About two years before, in the first siege of Bhurtpore by Lord Lake, the repeated assaults ordered by that gallant General had been repulsed, chiefly by explosions of gunpowder prepared in the ditch. More recently, the East India Company's engineers have everywhere distinguished themselves by their superior skill in mining, especially at the second siege of Bhurtpore in 1826, though the native miners there had lost nothing of their former energy, for they actually penetrated into one of our galleries, where a combat took place, in which a captain of the engineers was wounded. Their efforts were, however, unavailing, for the Company's engineers opened the way for our storming parties into that supposed invincible fortress by two great mines, one of which not only effected a broad and practicable breach, like the other, but levelled in the dust a large circular bastion, on which 300 or 400 of the enemy's bravest troops were posted, who were all destroyed by the explosion. I need scarcely mention that the East India Company's engineers performed the same important service in Lord Keane's attack of Ghuznee in 1839. Failures on either of those occasions, such as had previously occurred after the beginning of the present century, would have shaken our Indian empire to its centre. In Europe and America, where the Royal Engineers only are employed, mining has not been required in any of our military operations subsequently to

the close of the Peninsular war, so that they have not had the same opportunities of establishing their character for skill in mining which their friends and contemporaries of the same branch of service in India have enjoyed.

If my first letter, which appeared in your columns of the 24th of January last, had not been full of inaccuracies, I would not have troubled you either with the above account of the great mines at Dover, or with the observations on the progress of the art of mining in the British service, into which I was led in the course of my narrative, for the length of which I beg to apologize, and am, Sir,

Your most obedient servant
C. W. Pasley, Major-General.

TECHNICAL NOMENCLATURE OF STEAM VESSELS, IN ENGLISH AND FRENCH.

Principal Dimensions.	*Dimensions principales.*
Length at the fore part of the stem to the stern-post, at the rebate of the keel	Longueur de l'avant de l'étrave à l'arrière de l'étambot, à la râbleure de la quille
Breadth, extreme	Largeur hors bordure
Moulded	Largeur hors gabariage, ou hors membrure
Depth in hold	Creux ou profondeur de cale
Burthen in tons	Port en tonneaux, ou tonnage
Frame and Without-Board.	*Membrure et Extérieur.*
Keel—Stem—Apron	Quille—Etrave—Contre-étrave
Stemson	Marsoin-d'avant
Stern-post—Inner-post	Etambot—Contre-étambot
Wing-transom	Lisse d'hourdy
Counter-transom	Barre d'écusson
Deadwood—Keelson	Massif—Carlingue
Fashion pieces	Cornières ou estains
Knight-heads	Apôtres
Hawse pieces	Allonges d'écubiers
Room and space	Intervalle entre les couples
Cross pieces or short floors	Oreillers ou petits varangues
Half floors	Demi-varangues
Lower futtocks	(Allonges les plus basses.) Genoux
Second futtocks	(Deuxièmes allonges.) Premières allonges
Frame—Midship frame	Couples—Maître-couple
Main wales—Top-sides	Préceintes—Œuvres mortes
Sheer strakes	Virures de vibord
Bottom plank	Bordage de la carène
Garboard strake	Gabord
Counter plank	Bordure de la voûte
Plansheer or gunwale	Plat-bord
Within-Board.	*Intérieur.*
Thick strakes on the floor heads	Vaigres d'empâture
Engine bearers or keelsons	Carlingues de la machine
Shelf pieces to receive the ends of the upper-deck beams	Gouttières renversées pour recevoir les extrémités des baux de pont supérieur
Clamp under the shelf-piece	Banquière sous la gouttière renversée
Strake under the clamp	Sous-banquière
Diagonal iron plates	Bandes de fer diagonales
Diagonal plank	Vaigrage diagonal
Cabin platforms	Planchers des chambres
Paddle beams	Grandes baux des roues à aubes
Iron knees to paddle beams	Courbes en fer de ces baux
Iron stays	Arcs-boutant en fer
Spring beam	Traversin ou élonges des roues
Paddle cases	Tambours des roues
Sponsings	Soufflages ou saillies sur les côtés du navire, à l'avant et à l'arrière des tambours
Upper-deck beams	Baux du pont supérieur
Waterway	Gouttière
Flat of the deck	Bordure du pont
Rough-tree timbers	Montants de batayole
Rough-tree rail	Lisse de batayole
Towing timbers	Bittons de touage
Breasthooks, upper deck	Guirlandes de l'avant du pont supérieur
Hook at the platform deck	Guirlande du faux-pont
Hook in the hold	Id. de la cale
Crutches	Guirlandes de l'arrière
Windlass	Guindeau
Paul-bitt	Bitte du linguet
Carrick-bitts	Montants latéraux
Cat-heads	Bossoirs
Forecastle and quarter-deck beams	Baux des gaillards d'avant et d'arrière
Sundries.	*Divers.*
Davits	Davier pour traverser l'ancre
Rudder—Pumps	Gouvernail—Pompes
Head, stern, and quarter gallery	Guibre, poupe, et bouteilles
Mast and bowsprit partners, comings, companions, and skylights	Etambrais de mât et de beaupré, cadres d'écoutilles, capots d'échelles, et claires-voies
Steering-wheel—Tiller or yoke	Roue de gouvernail—Barre
Chain cable lockers	Puits pour câbles-chaînes
Engine-room bulkheads	Cloisons transversales de la chambre de la machine
Copper	Cuivre (doublage)
Caulking	Calfatage
Joiners'—Plumbers'—Glaziers'—Painters' work	Menuiserie—Plomberie—Vitrerie—Peinture
Masts—Yards—Blocks	Mâts—Vergues—Poulies

REVIEWS.

Sewers, Surrey and Kent. Reports relating to the Sewage with reference to the Observations of the Poor Law Commissioners. London: 1843.

In former numbers of this journal we undertook the task of exposing the presumption and misrepresentations of Mr. Chadwick in his remarks upon the Metropolitan Sewers. The observations we then made were fully supported by the information we had received from various Commissions, and their accuracy is further proved by the reports before us, to which we earnestly solicit the attention of our readers. No man who is at all acquainted with the subject will pretend to assert that the Commissions are all that could be desired, or that improvements cannot be introduced in the construction of sewers, but on the other hand, no man, having a due respect for public

opinion, will say that "the sewage of the metropolis is a vast monument of defective administration, of lavish expenditure, and extremely defective execution." Having on a former occasion defended the profession from the ignorant and presumptuous denunciations of Mr. Chadwick, we hail the reports before us as a conclusive evidence of the justice of the remarks we then made on the subject.

The Commissioners of Sewers for the limits extending from East Moulsey in Surrey to the Ravensbourne in Kent, referred the Report of the Poor Law Commissioners in January last to a committee of general purposes, "in order that the observations contained in it respecting sewage, and the working of Commissions of sewers in the metropolis, might be carefully examined with reference to the justice or injustice of the same," more particularly as against their own commission. The result of this inquiry, with the reports of the three surveyors to the commission, all of them important documents, have been printed by order of the court, and together offer an admirable answer to Mr. Chadwick's charges. It is, however, to the former document only that we shall refer, as we intend to publish one or more of the surveyors' reports in our next number.

The portion of the metropolitan district under this commission includes "the whole of the level between Battersea in Surrey and the Ravensbourne river at Deptford in Kent; bounded on one side by the river Thames, and on the other by the high lands of Clapham, Stockwell, Peckham, and Deptford." The history and present state of the sewage in this district is worthy of attention.

"The period has not long passed when this portion of the metropolis was very thinly populated: the building of Westminster and Blackfriars' bridges, which were completed respectively in the years 1750 and 1751, and the public roads which were then made through the district, very materially contributed to the increase of its population.

From the commencement of the present century the population on the Surrey side of the Thames increased rapidly, and the attention of the Commissioners of sewers was directed to the necessity of providing additional and improved sewage to meet the altered state of the district from open lands to lands covered with houses.

In 1809 the Commissioners applied to parliament for enlarged powers in the most populous part of the district. This led to the passing of the local Act, 49 Geo. III. c. 183, which appears to have been the subject of much opposition by the inhabitants for whose benefit it was sought to be obtained.

By that Act the commission obtained powers to make new sewers, and the power to cleanse private drains when neglected by the owners.

It will be in the recollection of many of the inhabitants of the district, that at this period in particular (1809) the whole of the lowlands between Southwark and Deptford, and also above Vauxhall and Battersea, were in the winter months frequently covered to a considerable depth with water, which remained several weeks, the existing sewage being inadequate to carry it off.

It will also be recollected that the cellars and underground apartments of many of the houses in Southwark were partly filled with water of a foul and disagreeable nature, which the inhabitants, for their own comfort, but to the great annoyance of passengers, were obliged to pump into the public streets, so that it might escape by the high level sewers.

In the following session of parliament (1810) the Commissioners again sought further powers over parts of the district under their care, and though still opposed by the inhabitants, the local Act 50 Geo. III. c. 144 was obtained.

In the year 1813 the subsequent local Act 53 Geo. III. c. 79 was passed.

Under these several local acts, the Commissioners obtained power to make new sewers, and also to borrow money to carry on works, and from this period may be dated the great improvements that have been made in the district, leading to the removal of all the overflowing of the low land between Southwark and Deptford, Vauxhall and Battersea (much of which has been converted into building and garden ground), the cellars and underground apartments of the houses of the inhabitants have also been completely drained wherever the Commissioners have been able to carry their works."

We will not follow the Report in its defence of the Commission of Sewers against Mr. Chadwick, whose opinions are not really worth the serious condemnation we have given them, and whose vanity must be not a little excited by the trouble we and others have taken to expose it; but rather draw public attention to the source of all the evils which do attend the present mode of providing sewage for the Metropolitan districts.

By the General Sewers Act, passed in 1833 (3 & 4 Wm. IV. c. 22, § 21), the Commissioners are prevented from making a new sewer, "except with the consent in writing, certified to the court, of the owners and occupiers respectively, and their respective husbands, guardians, trustees, or feoffees, committees, executors or administrators, of three fourth parts, at the least, in value of the lands and hereditaments, level or district, proposed to be charged with the cost and expenses of making and executing such new works respectively." That such a provision must have the effect of retarding the desired works, there can be no doubt, for there are few persons who consider a public good, even when they derive a temporary private advantage, if they are called upon to pay for it. The manner in which this clause of the act operates, not to speak of many other provisions equally injurious, is very properly stated in the Report before us:—

"The freeholder has frequently a less interest than the lessee (who perhaps built the house,) and the occupier, who, by his holding, may have to bear the expense, has also an interest minor to the lessee, yet by the clause set out, all are to be consulted, and the Commissioners have no power to act but with the consent, in writing, of three-fourth parts of the whole of them.

It is always difficult in a populous district to ascertain the parties who would be comprised within the words of the act, but the occupier is clearly one; and as the burthen of the rate is too generally thrown on him by agreement with his landlord, he is found mostly to object to an outlay which, though admitted to create an improvement in the neighbourhood, he considers oppressive on him, on account of the smallness of his interest, in comparison with that of the owner of the property.

Another difficulty has also presented itself, in attempting to carry out this clause, arising from the legislature having omitted to point out the modes in which the consents are to be obtained. It hardly could be intended that the Commissioners themselves, or their officers, should seek them—it must rather have been expected that parties interested in the execution of a new work would, on their application to the Commissioners to set in motion the powers vested in them, have come prepared with such a document. However this may be, the clause operates to prevent the execution of new sewage."

Under such a restrictive clause, it must surely be less a matter of surprise that, in a city which is now more rapidly extending itself than perhaps at any former period of its history, which is more than coeval with the present era, there should be districts where the sewage is incomplete, than that so much should have been done in an interval of less than forty years. Speaking of the present system, in reference to what has been accomplished by it, we say, with a readiness to prove the assertion, that it has worked well, and far better than such a system of centralization as the Poor Law Commissioners seem to contemplate could possibly have done. It is, however, time that an unprejudiced inquiry should be made by persons competent to the duty, and we again repeat that the blame or praise must be proportioned to the powers given to the Commissioners by the law under which they have acted. This fact Mr. Chadwick seems to have overlooked, and has consequently made many erroneous statements, seriously affecting the public character of men who have a station in society equally as respectable as his own. In this case, however, he may have erred from inadvertence or a want of judgment; but in his attacks upon professional men and professions, he is without excuse; they were prompted by ignorance, impudence, and a neglect of duty, and for these he is answerable at the tribunal of public opinion.

A Manual for teaching Model-Drawing. By Butler Williams, C.E., F.G.S. London: Parker: 1843.

Instructions in Drawing, for the use of Elementary Schools. By Butler Williams, C.E., F.G.S. London: Parker. 1843.

These works are from the pen of the director of the drawing-classes at Exeter Hall, and they are published by the authority of the Committee of the Council of Education. The latter work, which is called "Instructions in Drawing," is an abridgment of the "Manual," and is intended to facilitate the introduction of model drawing into elementary schools, and will be found to contain all that is necessary to direct the teacher. The remarks we may make upon the larger book are therefore applicable to the smaller, and as it more fully developes the system adopted by the author, should be preferred by both learners and teachers. Mr. Butler says that it has been prepared especially for the use of the latter, and that it would be injudicious to place it in the hands of children without the assistance of a teacher to explain the apparent difficulties, or at least without models to serve in illustration of each proposition. Of this we have no doubt, but there are many persons who ought, and some who desire to learn the art of drawing, who are not children; men who feel the necessity of the acquirement in the every-day business of life, or who are conscious that it would greatly add to their personal enjoyment, and give them the power of perpetuating objects and scenes which, however pleasing, are soon lost, if unrecorded, among the novel impressions which are produced by new conditions and circumstances.

There are few persons who have received what is called a liberal education who have not been taught drawing, and yet we meet with but few who are able, three or four years after they have shaken off the restrictions of boyhood, to represent upon paper the most common and simple forms of objects. We sometimes see a young man who tells us that he was once taught drawing, puzzling himself to represent in an intelligible way something of which he has a very clear perception, and which he wishes to convey to our minds, but after many vain efforts he throws up his pencil in despair; yet he finds little difficulty in communicating by description and similes what he fails to represent in its bare outline. There must be something wrong in the system of tuition, or such a circumstance could not happen. Writing is a mode of communication much less universal than drawing, and yet a man who has been once taught that art does not fail to make himself understood to those who have learned the meaning of the forms he uses, how badly soever he may represent them. And if the same man had been properly taught to represent the forms of objects, he would be equally capable of so representing them to others as to be perfectly intelligible. But the truth is, that it is not the custom to teach the mode of drawing objects, but the representations of those objects—a boy is not taught to draw a tree, a house, a bridge, but a picture of them, and consequently when he wishes to do so he finds himself as destitute of the power as if he had never touched a pencil, or made a single attempt to exercise his powers of imitation.

Mr. Williams's system of model-drawing is a great improvement upon the mode of teaching hitherto adopted, and will, we have no doubt, soon place the education of the children in our national schools, in this respect, far beyond that of the "young gentlemen" who are, at a great cost of time if not of money, pursuing the old system of copying. It will lay a good foundation for the student, and by accustoming the eye and the hand to the correct representation of geometrical forms, and gradually conveying to the mind all the principles of perspective, give a confidence founded on knowledge, not easily to be obtained by any other means. But to those who study drawing with a view to its ultimate application in the arts, the system is peculiarly adapted, and especially to the youth intended for the profession of architecture or engineering. More will be learned in one month from model-drawing than in twelve by the old system of copying.

The manner in which Mr. Williams proposes to teach is also very satisfactory. Perspective, instead of being left as a dry study to be acquired when the pupil has attained the power of copying, is commenced with almost the first lesson, and it seems to us impossible that a boy thus taught can fail to acquire a perfect knowledge of this most important branch of optical science, which is the only foundation for the art of drawing. As an elementary treatise of Drawing, we can strongly recommend it to our readers.

INSTITUTION OF CIVIL ENGINEERS.

COMMUNICATIONS.

January 10. *The President in the Chair.*—The business of the meeting was commenced by reading an abstract of Mr. Davison's paper No. 539,) describing the mode adopted for sinking a well at Messrs. Truman, Hanbury, Buxton, and Co.'s Brewery, which was published in the minutes of proceedings of the session 1842, and the following observations were made.

Mr. Braithwaite described the difference between the method employed in sinking the well for Messrs. Truman and Co., and that for Messrs. Reid and Co. In the former the bore was small, and would therefore only produce as much water as was procured from the veins through which it passed vertically; while the latter, by its larger diameter, permitted lateral galleries to be driven in the direction of the fissures in the chalk: thus forming feeders for the well, and at the same time capacious reservoirs, wherein the water accumulated when the pumps were not at work.

He attributed the comparative failure at Messrs. Truman's, to errors in the mode of sinking: the length of the cylinders which had been attempted to be forced down was too great, and the lateral pressure had prevented them from reaching the chalk, so that when the pumps were set to work, an undue quantity of sand was drawn up with the water, causing a cavity behind the brick-work, which at length fell in. The water having been pumped out to a lower level than was proper, the equilibrium between the water and the sand around the cylinder had been disturbed, and the "blow" of sand had ensued.

The New River Company had been advised to sink a well of sufficient diameter to enable them to excavate lateral galleries, but they had sunk their well in the Hampstead Road, of a small diameter, as described in the paper by Mr. R. W. Mylne, published in the Third Volume of the Transactions of the Institution; and although fissures had fortunately been traversed, which gave an ample supply of water, many of the difficulties encountered would, he contended, have been avoided by adopting the larger diameter, and sinking the cylinders into the chalk, before the pumping was commenced.

The supply of water at Messrs. Reid's well had been sensibly affected by the recent proceedings at the Hampstead Road well, which was now being constantly pumped in order to sink it deeper.

Mr. Davison explained that a bore of small diameter had been adopted, because it was calculated that a supply of water, sufficient for the wants of the brewery, would have been obtained by it. The excavation to within 5 feet of the chalk was suggested by the sudden dropping of the cylinder. He believed that when (contrary to his express instructions) the level of the water was reduced by pumping to below a given point, the sand from beneath the oyster-bed rushed in to restore the equilibrium within the cylinder, and thus caused the difficulties which he had to contend with.

During the last year the pumps had been at work 1616 hours, in which time 300,000 barrels, or 50,000 tons of water had been drawn from the well.

Mr. Farey believed that the casualties in well sinking generally arose from the sources which had been mentioned. Mr. Woolf encountered them when sinking the well at Messrs. Meux, (now Mess. Reid's) Brewery. The pumping up of sand with the water was there carried to such an extent as to cause an accumulation of sedi-

ment 2 feet deep in the liquor back, in 14 days, and ultimately the new well broke into the old one adjoining it.

Mr. Braithwaite explained that in the year 1814, the well at Messrs. Meux was pumped "to clear the spring," which caused a cavity of nearly 40 feet deep from the sides of the well, and endangered the stability of the buildings around. Piles were therefore driven to support the upper ground, and upon them the brick steining was carried up. If the cylinders had in the first instance been carried down to the chalk, before the pumping had commenced, this accident would not have occurred.

Mr. Vignoles remarked that the same question as to the relative merits of boring or sinking had been discussed at Liverpool, for wells in the red sandstone, and in practice it had universally been found that by the latter system the best supply of water had been procured, particularly when side drifts had been made.

Mr. Mylne said that the works at the well at the Hampstead Road, which had been repeatedly stopped from accident, were now resumed as an experiment; the quantity of water obtained was more than could be drawn by a pump 12 inches diameter, 6 feet stroke, making 10 strokes per minute (equal to 294 gallons per minute). The spring was struck at about 234 feet below the surface of the ground, and when the engine was regularly at work, the water generally stood at within 20 feet from the botom of the well. He coincided in the opinion of the advantage of a well of large diameter over one of small bore, as it permitted side excavations to be made in search of water. This plan had been pursued with success at Brighton.

Mr. Taylor observed that another of the advantages of the large diameter was, that the proceedings could be watched, and accidents could be more readily remedied; the opinion of all practical miners was, that the large diameter was cheaper, as well as better, than the small bore.

Mr. Clark promised an account and drawings of a well now sinking by him at the Royal Mint. The advantages of a large diameter were manifest to all practical men, particularly when the auger or "miser" was used, as it enabled the operation to be continued without pumping; the cylinders, in lengths of not more than 30 feet each, followed the "miser" down regularly, and as soon as they reached the chalk, the operation was considered safe; and as the "miser" did not excavate more than was due to the area of the cylinder, the equilibrium between the water within and the sand without the cylinder, was never disturbed. In a well sunk by him at Messrs. Watney's Distillery, the cylinders were 11 feet diameter; the "miser" used was 5 feet diameter, and was turned by twelve men at a time.

Mr. Braithwaite concurred in the advantages of using the "miser," he invariably employed it, and generally with success.

Mr. Farey believed that the "auger" or "miser" was first used in this country by the late Mr. Vulliamy of Pall Mall, for sinking an Artesian well, into which there was an irruption or blow of sand, the effect of which was only overcome by this instrument.

An Experimental Inquiry as to the Co-efficient of Labouring Force in Overshot Water-wheels, whose diameter is equal to, or exceeds the total descent due to the fall; and of Water-wheels moving in circular channels. By Robert Mallet, M. Inst. C. E.

This paper is partly mathematical, and partly experimental. The investigation which it details, the results of which are given in the tables of experiments, had in view principally to obtain the definite solution of the following questions:

1st. With a given height of fall and head of water, or in other words, a given descent and depth of water in the pentrough, will any diameter of wheel greater than that of the fall give an increase of labouring force (*i. e.*, a better effect than the latter), or will a loss of labouring force result by so increasing the diameter?

2nd. When the head of water is necessarily variable, under what conditions will an advantage be obtained by the use of the larger wheel, and what will be the maximum advantage?

3rd. Is any increase of labouring force obtained by causing the loaded arc of an overshot wheel to revolve in a closely fitting circular race, or conduit; and if so, what is the amount of advantage, and what the conditions for maximum effect?

The author briefly touches upon the accepted theory of water-wheels, the experimental researches of Smeaton, and the recent improvements in theory, due to the analytic investigations of German and French engineers.

Smeaton, in his Paper on Water-wheels, read to the Royal Society in May, 1759; and Dr. Robison, in his Treatise on Water-wheels, lay down as a fixed principle, that no advantage can be obtained by making the diameter of an overshot-wheel greater than that of the total descent, minus so much as is requisite to give the water, on reaching the wheel, its proper velocity.

The author, however, contends that while the reasoning of the latter is inconclusive, there are some circumstances which are necessarily in favour of the larger wheel, and that conditions may occur in practice, in which it is desirable to use the larger wheel, even at some sacrifice of power; and that hence it is important to ascertain its co-efficient of labouring force, as compared with that of the size assigned by Smeaton for maximum effect.

The author states, first, the general proposition, that the labouring force ("travail" of French writers), or "mechanical power" of Smeaton, of any machine for transferring the motive power of water "is equal to that of the whole moving power employed, minus the half of the *vis vies* lost by the water on entering the machine, and minus the half of the *vis vies* due to the velocity of the water on quitting it." He deduces from the theory the following results, coinciding with the conclusions obtained by experiment.

1st. If the portion of the total descent passed through by the water before it reaches the wheel be given, the velocity of the circumference should be one-half that due to this height.

2nd. If the velocity of the circumference be given, the water must descend through such a fraction of the whole fall before reaching the wheel, as will generate the above velocity.

3rd. The maximum of labouring force is greater, as the velocity of the wheel is less; and its limit theoretically approaches that due to the whole fall.

General equations are given, expressing the amount of labouring force in all the conditions considered, and their maxima.

One of the principal advantages of using an overshot wheel greater in diameter than the height of the fall, is the power thus afforded, of rendering available any additional head of water occurring at intervals, from freshes or other causes, by admitting the water upon the wheel at higher levels.

The first course of experiments is dedicated to the determination of the comparative value of two water-wheels, one of whose diameter is equal to the whole fall, and the other to the head and fall, or to the total descent; by the head being in every case understood the efficient head, or that due to the real velocity of efflux at the shuttle, as determined according to Smeaton's mode of experimenting.

The apparatus employed in this research consisted of two accurately made models of overshot wheels, with curved buckets; these were made of tin plate, the arms being of brass, and the axles of cast-iron. Special contrivances were adopted to measure the weight of water which passed through either wheel during each experiment, to preserve the head of water strictly constant, and to determine the number of revolutions, and the speed of the wheels.

One wheel was 25·5 inches diameter, the other, 33 inches diameter. The value of the labouring force was determined, directly by the elevation of known weights to a height, by a silken cord over a pulley; the altitude being read off, on a fixed rule placed vertically against a lofty chimney; and in other experiments, relatively by the speed of rotation given to a regulating fly or vane. The depth of the efficient head was in all cases 6 inches.

The weight of water passed through either wheel in one experiment, was always 1000 pounds avoirdupoise.

All the principal results given in the tables accompanying the paper, are the average of five good experiments. From the large scale upon which these are conducted, the accurate construction of the apparatus, and the care bestowed upon the research, which was undertaken with reference to an actual case in the author's professional practice, he is disposed to give much confidence to the results.

The weight of water contained in the loaded arc of each wheel is accurately ascertained, and in the tables which accompany the paper, the results of the several experiments are given at length.

The velocity of the wheels, under different circumstances, is carefully noted and discussed with respect to the maximum force.

The author next ascertains the value of the circular conduits, and states that generally, in round numbers, there is an economy of labouring force, amounting to from 8 to 11 per cent. of the power of the fall, obtained by the use of a conduit to retain the water in the lower part of the buckets of an overshot wheel, whose diameter is equal to the fall. The velocity of a water-wheel working thus, may vary through a larger range without a material loss of power, and a steady motion is continued to a lower velocity than when it is working in a free race.

The author finally arrives at the following general practical conclusions:—

1st. When the depth of water in the reservoir is invariable, the diameter of the water-wheel should never be greater than the entire height of the fall, less so much of it as may be requisite to give the water a proper velocity on entering the buckets.

2nd. Where the depth of water in the reservoir varies considerably and unavoidably, an advantage may be obtained by applying a larger wheel, dependent upon the extent of fluctuation and ratio in time, that the water is at its highest or lowest levels during a given prolonged period; if this be a ratio of equality in time, there will be no advantage; and hence, in practice, the cases will be rare when any advantage will be obtained by the use of an overshot wheel, greater in diameter than the height of fall—minus, the head due to the required velocity of the water reaching the wheel.

3rd. If the level of the water in the reservoir never fall below the mean depth of the reservoir, when at the highest and lowest, and the average depth be between a eighth and a tenth of the height of the fall, then the average labouring force of the large wheel will be greater than that of the small one; and it will of course retain its increased advantage at periods of increased depth of the reservoir.

Dr. Robison's views, therefore, upon this branch of the subject, should, he contends, receive a limitation.

A positive advantage is gained by the use of the conduit, varying with the conditions of the wheel and fall, of nearly 11 per cent. of the total power.

The value increases with the wheel's velocity up to 4½ feet per second, or to 6 feet per second in large wheels. Hence, he argues, that it is practicable to increase the efficiency of the best overshot wheels, as now usually made, at least 10 per cent. by this application. The only objections urged against the use of the conduit are of a practical character, relating to the difficulty of making it fit close, of repair, &c.; but, however these may have applied to the rude workmanship of the older wooden wheels, with wood or stone conduits, they are unimportant as referring to modern water-wheels made of iron. The conduits may also be made of cast-iron, provided with adjusting screws, and are hence capable of being always kept fitting, readily repaired, and of being withdrawn from the circumference of the wheel in time of frost, &c.

The paper is illustrated by a drawing, giving the elevation and partial sections of the experimental apparatus, and by a diagram showing the full size of the loaded arc of each model.

Mr. Farey observed, that the result arrived at by the experiments appeared to correspond nearly with those recorded by Smeaton, who had experimented upon, and used practically both kinds of wheels. The buckets of the model wheels used in the experiments did not appear to be of the best form, and they were entirely filled with water; hence an apparent advantage had been obtained, by the use of the circular conduit to retain the water in the buckets. But that would not be realized in practice, for as the form of the bucket regulated the point at which the water quitted it, and it was the practice of the modern millwrights to make the wheels very broad, in order that the buckets should not be filled to more than one-third of their depth, the circular conduits became less useful, and in fact were now seldom used. Smeaton's practice was to entirely fill the buckets with water, but he never adhered to the slow velocity of revolution which he recommended theoretically, in his Paper to the Royal Society.

Mr. Fairbairn had adopted broad wheels with an improved form of bucket partially filled, and had obtained a more regular motion, particularly at high velocities.

Mr. Farey promised to present to the Institution a copy of the method of calculation adopted by Smeaton for water-wheels.

Mr. Taylor corroborated Mr. Farey's statement of the advantage of using broad wheels, with the buckets of a fine pitch and partially filled; circular conduits then became unnecessary: this was practised among the millwrights in North Wales with eminent success, and a velocity of 6 feet per second was given to the wheel.

Mr. Homersham believed that in Smeaton's latter works, he increased the velocity of his wheels to 6 feet per second.

Mr. Rennie then gave credit to the author for the ingenuity of the apparatus with which the experiments were tried, and for the clearness of the tabulated results; but owing to the necessary limited size of the model wheels, he feared the results could not be relied upon for application in practice to large wheels. The experiments of Borda, Bossut, Smeaton, Banks, and others, were all liable to the same objection.

The best modern experiments were those by the Franklin Institute, by Poncelet, and by Morin.

The result of these might be taken thus:

Undershot wheels, the ratio of power to effect, varied from				0·27 to 0·30
Breast wheels	„	„	„	0·45 to 0·50
Overshot wheels	„	„	„	0·60 to 0·80
Average	„	„	„	0·60

The velocity of the old English water-wheel was generally about 3 feet per second; the American wheels 4 feet, and the French wheels 6 feet: this latter speed was now adopted by the best millwrights in England. Mr. Hughes (at Mr. Gott's factory at Leeds,) and Mr. Fairbairn had found advantage from it; the latter also had a particular contrivance for carrying off the air freely from the buckets.

It was important to regulate the thickness of the sheet of water running over the shuttle upon the wheel. The best maximum depth was found, in practice, to be from 4 to 5 inches.

The object being to utilize the greatest height of fall and the greatest available quantity of water, by means of properly constructed openings and such sluice-gates as were first introduced by the late Mr. Rennie for the breast-wheels constructed by him, instead of penning up the water in a trough, it was made to flow in a sheet of regular thickness over the top of the shuttle, and by a self-regulating apparatus to adjust itself at all times to the height of the water. Thus obtaining the advantage of the full height of the fall at its surface, and obviating the necessity for the apparatus proposed by Mr. Mallet.

Mr. Mallet begged to dissent from the validity of the objections which had been made to the practical value of his experiments. With respect to the form of the bucket; that used by him could not, he contended, be called a bad form, although it might be susceptible of improvement, but as the experiments were altogether comparative, it was foreign to the question whether the form was bad or good, the same having been used in both wheels.

As it was shown that a certain relation subsisted between two water-wheels with the same total descent, but with different diameters, as to their co-efficient of labouring force, a proportional relation would exist with any worse or better form of bucket. The results, considered as absolute measures of effect, being obtained with a form of bucket which approached nearer to the best forms now in use, than did those of Smeaton or any other experimenter, were more applicable to modern practice, and therefore he must consider his results as not without utility.

With regard to the custom of only partially filling the buckets, it must be remarked, that buckets of the best form begin to spill their contents before arriving at the lowest point of the loaded arc; the partial filling could therefore only palliate the evil which the circular conduit was designed to remedy. He must, however, argue that a positive disadvantage attended the partial feeling. A permanent loss of fall was produced, equal to the distance between the centres of gravity of the fall, and of the empty portion of the top bucket at the moment it had passed the sluice; this distance could be but little varied by the fineness of pitch of the bucket, and depended more upon the depth of the shrouding. That there was a constant loss of labouring force, by a practical diminution of the effective leverage or a reduction in the "moment" of the loaded arc; that as the wheel revolved, the centre of gravity of the fluid contained in each bucket, as it approached the lower portion of the loaded arc, was transferred to a greater distance from the centre of motion even before the contents commenced spilling; but the angular motion of the centre of gravity of any one bucket, was at first that due to its distance from the centre of motion of the wheel, or to its radius; and as the radius increased, a greater angular velocity would be acquired by the water, which had changed its position on approaching the lower point of the wheel, but this increased velocity was given at the expense of the power of the wheel, and hence a partially filled bucket would, he believed, be always attended with a loss of labouring force. To the last objection, a full bucket was not liable.

From these reasons, he felt justified in concluding that the use of the circular conduit was more advantageous than the practice of partially filling the buckets.

With respect to the shuttle delivering the water over the top; where the head of water and the fall were constant, no advantage could be obtained by the use of a wheel greater in diameter than the total descent; it was assumed that this form of shuttle would be used, in order always to deliver the water as high as possible upon the periphery of the wheel; but the question was, "If the head be variable, what should be the diameter of the wheel to secure the best effect?" The paper showed that a wheel whose diameter was equal to the total descent, when the head was a maximum, did not always give the greatest average labouring force. The question was, therefore, independent of the sort of shuttle used; it assumed the

power of always admitting the water upon the wheel at the highest point of the total descent, and sought to establish the best relation between the diameter of the wheel and the whole descent, when the head alone was variable, according to given conditions. The results of this part of the investigation, therefore, while they admitted the full value of Mr. Rennie's shuttle, went further, and pointed out the limits of its useful application.

He was fully aware of the prejudice which existed against the circular conduit, and he once participated in it; but his attention had been forcibly drawn to it in his professional practice, and having used it very beneficially upon wheels of 40, 50, and 60 horses' power which he had constructed for mining purposes, he wished to draw the attention of engineers to the consideration of its practical merits when adapted to good wheels.

CORRESPONDENCE AND MISCELLANEOUS INFORMATION.

The Study of Nature.—[The following is an extract from a letter received by the Editor from an esteemed friend, who has grown grey in the study of the arts, and whose father and grandfather left works which will, like his own, be admired and studied by posterity, for their grace, elegance, and natural simplicity.]—Ed.

You ask me my opinion as to the present state of the arts, and I will endeavour to reply with that frankness which belongs to sincerity, for I am gratified when my humble endeavours give the least encouragement or assistance to real genius, or tend to impede the progress of the intruder, objects in which, I know, from your early labours, you fully participate.

It has become a common saying, that the schoolmaster is abroad! If he is, I ardently wish that he would return home, for I fear the scholars are abroad also, but should the master persist in his neglect of duty, I really would advise the young gentlemen who are studying the arts not to play truant any longer, but immediately to repair to the school, and place themselves under the tuition of their good ancient school-mistress, Dame Nature. They have had a long holiday; they have visited Mount Parnassus, strayed over Greece, Italy, and indeed almost the whole continent; they have attempted to reach the top of Olympus itself, and to gambol with Jove; they have tried to steal the peacock plumes from Juno, and purloin the girdle of Venus; they have ventured to break a lance with Minerva, and to coax the lasses from Apollo; but alas, the young venturers have been tripped by that arch trickster Mercury, while he amused them with a sight of his golden bags, and tossed from the top of the hill to the bottom, and there they must have remained if they had not been assisted by the good old lady to whose tuition I have recommended them. But in plain terms, if the artists of this or any other country will not study nature, which the ancients did, they never can and never ought to attain the summit of excellence and glory, so long enjoyed by our forefathers. I speak positively, but I throw down the gauntlet, not caring who may take it up. Every other source has been tried, but has any one been successful, either in architecture, sculpture, or painting?

There are few forms in the best productions of the architect, which may not be at once traced to natural objects. Consider the figures presented by minerals, plants, and shells, and then say whether the first and noblest architects, the Egyptians, were not indebted to nature for the fine models they employed in the design of their pyramids, obelisks, columns, and temples. The beautiful crystal, the conical shell, and even the dense masses of matter may all be adapted in their forms, as well as in their substances, to the use of man—the propriety of the application varying with the skill or genius of the individual. This opinion I have formed upon no slight ground; I have spent a long life in the study of the arts, and desire above all things to see them progress in my native land. I have formed a very high opinion of some of those who have run with me on the same road, and I retain a great veneration for others who are no more; but still there are some with whom I must still differ in opinion, and they are unfortunately many.

Church Architectural Societies.—Sir, I regret that you and some of your correspondents have condemned the Church Architectural Societies. The letter signed "An Architect" in your last publication, induces me to make a few remarks on the subject. I am not connected with any of these societies, but I hail their formation with great pleasure, as I trust they will be the cause of much better and more appropriate churches being erected for the future than the highly objectionable buildings lately "run up" to serve for people to worship in. I apprehend the person who gives £2000 towards the new church at Torquay, entertains somewhat similar ideas on the subject.

I beg to suggest to "an Architect," that the best way to contend with the Exeter Society will be, to publish in your Journal an exposé of the manner in which these 144 "quack architects" show themselves to be no better than "quacks," that is, give an account of their derelictions from religious propriety, good taste or substantiality in any church erected under their superintendence.

Surely your correspondent is going much too far in intimating that the clergy are unnecessarily extending their knowledge in studying ecclesiastical architecture. I evidently wish the study (as well as music) had always formed a part of their duties when training for the sacred office, for are not half the chancels at their sole disposal as rectors of parishes? and has not the parish priest the power of preventing any improper alteration in a church, even though decided on by the churchwardens and parishioners. If they had possessed this knowledge heretofore, we should not now have to regret the irremediably mutilated and disfigured state in which many of our finest churches are, and in many cases these mutilations have been done under the direction of persons calling themselves "architects."

I can hardly see what other object the Exeter Society can have in view, in advertising for plans for the Torquay church, than to carry out the best that is submitted to them; my impression is, their own architect will not give any design, but even if he do, giving the Society (as your correspondent seems disposed to), the benefit of intending to act honorably in the transaction, in what does his advantage over the other competitors consist?

In conclusion, I must differ from "An Architect" when he says these societies have not been formed to advance the study of art. Before, however, the art can advance, it is absolutely necessary that we should make ourselves conversant with the feelings and motives which governed those who erected our churches when English architecture was in its flourishing state; that we do not understand much of these matters at present, is painfully apparent in the many wretched places which have of late years been erected, and unworthily designated by the name of churches, being little better than so many dissenting meeting-houses.

I am, Sir, your obedient servant,

Ashford, March 16, 1843. A. A.

Survey of London.—Sir, The following letter was written two months since with the intention of circulating it among the leading members of the professions, but having seen in the morning papers a paragraph intimating that an interview had been granted by Sir Robert Peel to several architects and surveyors, I presumed that the matter had been taken up by abler and more influential persons than myself.

The object and issue of that interview not being generally known, I have been unable to decide whether my ideas have really been anticipated or not, and am therefore induced to request that you will publish the letter which I had intended for private circulation only, that it may stimulate the professions to a united effort to prevent, if possible, a proceeding which will so injuriously affect their members.

I am, Sir, yours obediently,
J. Bailey Denton.

20th April, 1843.

(Copy of intended Circular.)

Sir,—The Commissioners appointed by Government for the examination of proposed Metropolitan improvements, are now engaged in considering the expediency of an Ordnance Survey and map of London upon a large scale. It is considered arbitrary in the extreme, that at a time when regularly educated surveyors and architects would be glad of a compensating employment, a host of sappers and miners, foreigners to the profession, should be engaged to execute a work for which experienced professional men are more competent, and who have in their possession many valuable and correct surveys of large portions of the metropolis, which might be made available for the purpose of supplying details, both with economy and dispatch.

Should your opinion coincide with the above, I beg you will inform me of your willingness to attend a meeting at which a memorial will be drawn up, expressive of the opinion of the profession, to be presented to the Board of Commissioners.

I am, Sir, your obedient servant,
J. Bailey Denton.

Congregational Chapel, London Road, Derby.—A new and elegant chapel has been recently erected in the London road, Derby,

from the designs of Mr. Stevens, resident architect. In the external character of this building the architect has attempted to employ the principal features of the ancient Roman temple, and to combine them harmoniously with an astylar Italian arrangement. The general plan is an oblong parallellogram 73 ft. 6 in., by 48 ft. 6 in. externally, with a tetrastyle portico at the entrance front, and a deep recess at the opposite extremity. The order adopted is the Corinthian, and is a modification of the examples in the Campo Vaccino at Rome, generally considered as the remains of the Temple of Jupiter Stator. It is elevated on a stylobate, which affords sufficient height for schools and class-rooms under the whole area. The portico is approached in its whole extent by a flight of nine steps; the columns are 2 ft. 10 in. diameter at the base, and the eustyle intercolumniation is adopted: it projects eleven feet, and is connected with the end of the building by square pillars with corresponding antæ at the four angles of the building. The flanks are brought out to the face of the antæ, and have each five large semi-circular headed windows with double reveals; the face of the inner one enriched with scroll ornaments; archvolts springing from continuous impost complete the decoration. The whole entablature of the order is continued round the building. A large arch under the portico leads into a recess, which affords access on each side to the lobbies, staircases, and chapel. The entrances to the schools are screened in front by a balustrade. The chapel is 70 feet long, 45 feet wide, and 42 feet high, including the lobbies and entrance recess, over which the gallery is continued. The ceiling is simple: it consists of a bold cove springing from a dentil cornice. The horizontal position of the ceiling is enriched by two parallel guiloches, and three circular ornamental openings, affording means of ventilation. The recess is filled by a vestry, and gallery over, which is separated from the body of the chapel by a bold elliptical arch springing from the impost. The ceiling of the recess is groined, and it is lighted by a window on each side. The chapel is calculated to seat 700 persons, and admits of the accommodation being increased one-half by an extension of the end gallery, and the addition of other galleries on the sides.

LIST OF PATENTS.

SIX MONTHS FOR ENROLMENT.

John Haggerston Leathes, of Norwich, gentleman, and William Kirrage, of the same place, asphalte manufacturer, for "certain improvements in coffins."—Sealed February 25.

John Heathcoat, and Ambrose Brewin, of Tiverton, lace manufacturers, for "certain improvements in the manufacture of ornamented net or lace."—Sealed February 28.

Gottlieb Boccius, of New-road, Shepherd's Bush, for "certain improved arrangements and apparatus for the production and distribution of light."—Sealed February 28.

George Bell, of Dublin, merchant, for "certain improvements in machines for drying wheat, malt, corn, and seeds, and for bolting, dressing, and separating flour, meal, and other like substances."—Sealed March 1.

John Frearson, of Birmingham, machinist, for "improvements in fastenings for wearing apparel."—Sealed March 2.

Thomas Simpson, of Birmingham, manufacturer, for a "certain improvement in buckles."—Sealed March 2.

Masta Joscelin Cooke, of Gray's-inn-square, solicitor, for "certain improvements in the manufacture of artificial fuel."—Sealed March 2.

John Keely, the younger, of Nottingham, dyer, and Alexander Alliott, of Lenton, bleacher, for "certain improvements in machinery or apparatus, for drying or freeing from liquid or moisture, woollen, cotton, silk, and different fibrous materials, and other subtances, and also for stretching certain fibrous materials," being a communication.—Sealed March 2.

William Walker, of George-yard, Crown Street, Soho, coachsmith, for "certain improvements in the manufacture of springs and axles for carriages." Sealed March 2.

Charles White, of Noel-street, Islington, engineer, for "certain improvements in machinery for raising and forcing fluids."—Sealed March 2.

Robert Stirling Newhall, of Gateshead, Durham, wire-rope manufacturer, for "improvements in the manufacture of wire-ropes, and in the apparatus and arrangements for the manufacture of the same."—Sealed March 7.

William Newton, of Chancery-lane, civil engineer, for "certain improvements in machinery or apparatus for making pins," being a communication.—Sealed March 6.

James Pilbrow, of Tottenham, engineer, for "certain improvements in the application of steam, air, and other vapours and gaseous agents to the production of motive power, and in the machinery and apparatus by which the same are effected."—Sealed March 7.

William Betts, of Ashford, Kent, railway contractor, and William Taylor, of the same place, plumber, for "improvements in the manufacture of bricks and tiles."—Sealed March 8.

William Kenworthy, of Blackburn, Lancaster, cotton spinner, for "certain improvements in machinery or apparatus, called 'beaming or warping machines.'"—Sealed March 11.

Charles Chilton, of Gloucester street, Curtain road, and Frederick Braithwaite, of the New Road, engineer, for "improvements in machinery for cutting or splitting wood for fuel and other purposes."—Sealed March 16.

Arthur Chilver Tupper, of New Burlington-street, Middlesex, gent., for "improvements in the means of applying carpets and other covering to stairs and steps, and in the construction of stairs and steps."—Sealed March 16.

Alexander Angus Croll, superintendent of the gas-works, Bricklane, Middlesex, and William Richards, of the same works, mechanical inspector, for improvements in the manufacture of gas for the purposes of illumination, and in apparatus used when transmitting and measuring gas or other fluids.—Sealed March 16.

Angier March Perkins, of Great Coram-street, engineer, for "improvements in the manufacture and melting of iron, which improvements are applicable for evaporating fluids, and disinfecting oils."—Sealed March 16.

John Thomas Betts, of Smithfield Bars, gent., for "improvements in the manufacture of metal covers for bottles and certain other vessels, and in the manufacture of sheet metal for such purposes," being a communication."—Sealed March 16.

Frederick Cook Matchett, of Birmingham, manufacturer, for "certain improvements in the manufacture of hinges."—Sealed March 16.

Martyn John Roberts, of Brynycaeran, Carmarthen, gent., for "improvements in the composition of ink, blacking, and black paint."—Sealed March 16.

James Malam, of Huntingdon, gas engineer, for "improvements in the manufacture of gas retorts, and in the modes of setting gas retorts."—Sealed March 16.

William Laycock, of Liverpool, merchant, for "improvements in constructing houses and such like buildings."—Sealed March 16.

Wakefield Pym, of the borough of Kingston-upon-Hull, engineer, for "certain improvements in the construction or formation of buoys, or other water-marks."—Sealed March 18.

Alexander Simon Wolcott, of City-terrace, City-road, machinist, and John Johnson, of Manchester, in the county of Lancaster, machinist, for "improvements in photography, and in the application of the same to the arts."—March 18.

William Barker, of Manchester, millwright, for "certain improvements in the construction of metallic pistons."—Sealed March 20.

Solomon Rolinson, of Dudley, Worcester, roll-turner, for "certain improvements in the manufacture of shot."—Sealed March 20.

Joseph Needham Taylor, of Chelsea, captain in Her Majesty's navy, and William Henry Smith, of 33, Fitzroy-square, civil engineer, for "certain improvements in breakwaters, beacons, and sound alarms; also in landing or transmitting persons and goods over or through strata or obstructions of any nature, all of which may be used either separately or in combination."—Sealed March 21.

Andrew Barclay, engineer and brass founder, Kilmarnock, Scotland, for "certain improvements in lustres, chandeliers, pendants, and apparatus connected therewith, to be used with gas, oil, and other substances, which invention is also applicable to other purposes."—Sealed March 24.

Gregory Seale Walters, of Coleman-street, merchant, for "improvements in the manufacture of chlorine and chlorides, and in obtaining the oxides and peroxides of manganese in the residuary liquids of such manufacture," being a communication.—Sealed March 24.

Alfred Hooper Nevill, of Chichester-place, Gray's-inn-road, corn dealer, for "improvements in preparing lentils and other matters for food."—Sealed March 24.